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VOLUME 43 JULY 19, 1954 NUMBER 15

THE USE OF OCTADECYL ISOCYANATE ON COTTON TO PRODUCE WATER REPELLENCY

CARL HAMALAINEN, J DAVID REID, and W NORBERT BERARD

Southern Regional Research Laboratory, Southern Utilization Research Branch

Agricultural Research Service, U S Department of Agriculture

Conditions necessary for the production of water-repellent cotton cloth by the use of octadecyl isocyanate have been studied. The isocyanate may be applied from organic solvent or from emulsion. Although the isocyanate can be made to react with the cellulose under some conditions, apparently the major portion of the water-repellent effect is due to decomposition of the isocyanate to a disubstituted urea deposited on the surface of the fibers. The treated cloth resists mild laundering conditions but is "shower resistant" only and is susceptible to penetration by water when dynamic water-repellency tests are employed.

INTRODUCTION AND DISCUSSION

WATER-REPELLENT clothing is of particular importance to the military forces and a launder-resistant finish capable of being applied under field or home conditions should be of considerable interest for both military and civilian use. It was with this object that the present investigation was undertaken. Attention was focused particularly on the possibility of reacting octadecyl isocyanate (ODI) with cellulose, especially since such alkyl isocyanates have become available recently on a commercial scale (*12*). Theoretically in a topochemical reaction only a small amount of reagent should be required to give water repellency and the product should be reasonably stable toward hydrolysis during laundering.

In the present investigation an attempt was made to react octadecyl isocyanate directly with cellulose to form the ester in accordance with the following reaction:

$$C_{18}H_{37}NCO + \text{Cell-OH} \rightarrow \text{Cell-O-CO-NH-}C_{18}H_{37}$$

An alternative course of reaction is the hydrolysis of the isocyanate to form a disubstituted urea:

$$2C_{18}H_{37}NCO + H_2O \rightarrow C_{18}H_{37}NH\text{-CO-NH-}C_{18}H_{37} + CO_2$$

The insoluble diurea should contribute to the water repellency of cellulose.

A number of patent references (*6,8,10,11,14*) have indicated the use of high-molecular-weight isocyanates as possible water-repellent agents, and octadecyl isocyanate is specifically mentioned. However, the extent of water repellency, the physical characteristics of the cloth and details of treatment are generally vague. Apparently the only commercial use of this isocyanate to confer water repellency is that reported to have been in use in Germany during the war (*3*). This was not, however, a direct reaction of cellulose with the isocyanate but the reaction product of cellulose with N-octadecyl-N′—ethylene urea, which was prepared by the reaction of octadecyl isocyanate and ethylene imine.

According to the patent literature (*6,8,10,11,14*), cotton cloth is made water repellent by treatment either with a water emulsion or an organic solvent solution of ODI followed by drying. No provision is made for removal of water before treatment. However, in patents covering the reaction of cellulose with some isocyanates such as halogenated phenyl isocyanates (*5*), the samples are dried by azeotropic distillation with benzene. With certain polyisocyanates, solvent interchange is used to dry the sample (*4*). It has also been reported that the sodium bisulfite addition product of octadecyl isocyanate in aqueous solution will confer water repellency when applied to cotton textiles with subsequent heating (*13*). In the light of these publications, preliminary experiments were made to determine optimum conditions for obtaining water repellency and the products were evaluated for water repellency.

It was found that, if a 5% solution of ODI in benzene was applied to cotton to approximately 100% wet pickup, the cloth would become water repellent if allowed to air dry for several days. Alternatively, the same effect could be obtained by heating 15 minutes at 105° C, or two minutes at 140° C. Some of the samples retained a good degree of water repellency even after repeated solvent extractions and laundering.

Indications were that both moisture content of the cotton before treatment and conditions of drying after treatment greatly affected the water repellency of the final product. Oven- or air-dried cloth gave good results when impregnated with ODI provided it was washed after curing and then oven dried. Both conditions were found to be necessary. Water-swollen cloth which was dried by solvent exchange and then treated with ODI did not retain its water repellency even though it was washed and dried later. Studies on the effect of concentration of ODI showed that 0.5% was too little, but that 2% or more gave good results. The ODI could be applied from petroleum solvent as well as from benzene. Application to garments could be carried out in a manner very similar to that employed in drycleaning at home. Drycleaning with solvent-containing drycleaner's soap allowed the samples to wet, showing that soap had remained and acted as a wetting agent, but the water repellency could be restored by washing with water and then oven drying.

Although the isocyanates hydrolyze readily with water, the reaction with ODI is much slower than with the short chain isocyanates. For this reason it is possible to make stable emulsions of ODI. Long chain

alkyl sulfates, such as Duponol G*, form stable emulsions in which the isocyanate is hydrolyzed only very slightly after several weeks standing. Application of ODI from aqueous emulsion to cloth gave results which were very similar to those obtained with organic solvents. It was found that about 1% of ODI remained on the cloth after treatment and part of this could be removed by extraction or laundering. It was not established what portion, if any, of the pickup was due to reaction with the cellulose.

Laboratory samples had good water repellency as judged by the surface tension index *(16)* or by the spray test *(1, 2)*, i e. water droplets did not wet the cloth and could be shaken off to leave a dry surface. However, when larger samples of cloth were treated on semicommercial wet-finishing equipment and tested it was found that the cloth was susceptible to penetration by water when the dynamic water repellency tests were employed. Therefore, if raincoats were made from the treated material they would be merely "shower resistant" and would not give adequate protection in heavy rainstorms. Under the conditions of treatment used, it was not found possible to increase the reaction of ODI with the cellulose so that water repellency could be achieved to pass the dynamic tests. It was concluded therefore that the ODI treatment was not promising and further work was discontinued.

MATERIALS AND TEST METHODS

MATERIALS———Octadecyl isocyanate was obtained from the Monsanto Chemical Company.*

Dioctadecyl urea was prepared by reacting octadecyl amine with octadecyl isocyanate in a solvent, such as pyridine, precipitating into water, and recrystallizing from hot alcohol.

The cotton fabrics used were kier-boiled 80-square print cloth, desized and caustic-boiled 5-oz poplin, khaki-dyed 5-oz poplin, and undyed 8.2-oz twill.

TEST METHODS———The simulated laundering procedure consisted of boiling the sample in alkaline soap solution (0.5% of laundry soap and 0.2% of Na_2CO_3) for 30 minutes, then rinsing in running hot tap water for 15 minutes.

The simulated drycleaning procedure consisted of agitating the sample for 25 minutes in a quart bottle containing carbon tetrachloride with 0.5% of drycleaner's potash soap, followed by three 5-minute rinses each with fresh carbon tetrachloride.

The "Rolling Drop Method" of Schuyten et al *(16)* was used to determine water repellency in preliminary tests. This method determines the resistance of the fabric to wetting rather than resistance to penetration of water.

In this method, solutions of various surface tesions are allowed to run down the surface of a cloth held at a 45° angle. When the surface tension is sufficiently low, a continuous aqueous film is left on the surface of the cloth. The lower the surface tension needed, the better is the water repellency of the cloth. Results are expressed in dynes/cm as the "surface tension index" (STI). Schuyten et al *(16)* have related the STI to a number of other test values. For example, cloth with a spray rating of 100 will give an STI of 35 to 42. When spray ratings varied from 100 to 70, the STI varied smoothly from 35 to 58 dynes/cm.

Methods used to determine fabric resistance to penetration by water under dynamic conditions were the AATCC-Slowinske rain test *(2)*, hydrostatic pressure *(2)*, drop penetration *(2)* and Bundesmann test *(18)*.

EXPERIMENTAL PROCEDURE AND RESULTS

REACTION OF OCTADECYL ISOCYANATE WITH CELLULOSE———To attempt to determine experimentally whether reaction occurred between ODI and cellulose, four 2-g samples of low viscosity linters were swollen by soaking in water. Two samples were dried by azeotropic distillation in xylene and two by solvent interchange with methanol, benzene and pyridine used successively. The first two samples were treated with 5% and 20% of ODI in xylene, and the latter two, with 5% and 20% of ODI in pyridine at reflux for 14 hours. The solutions were filtered hot. Samples were washed with boiling solvent (xylene or pyridine), then with boiling ethanol and finally with boiling water. All samples were highly water repellent. The nitrogen contents of the samples treated in xylene were 0.02 and 0.4% and those treated in pyridine were 0.69 and 1.00%. These values indicate total weight pickups of 0.38, 0.56, and 1.71 and 19.08% respectively. The latter value indicates a substitution of 1 carbamate group per 6.8 anhydroglucose units. Apparently, activated low-viscosity linters will react with ODI under optimum conditions. Although the addition of isocyanate is relatively slight in refluxing xylene, the 0.38% addition would be sufficient to cover the surface of the fibers if the reaction were topochemical.

A second experiment along these lines was undertaken to show the permanency of the treatment. Cotton print cloth was thoroughly extracted with hot ethyl alcohol, oven dried and then impregnated with a 5% of benzene solution of ODI. The sample was oven cured at 140°C and then washed in hot running tap water. It was then dried at 110°C. The STI was 33. One portion was extracted with hot acetic acid for 4 hours, washed and oven dried. The STI was 42. Another portion was extracted with hot acetone for 4 hours and part oven dried and part air dried. The STI's were 40 and 42 respectively. When these samples were heated at 140°C for 1 hour the STI was 38.

Some dioctadecyl urea formed and was obtained from the acetic acid and acetone extracts. It was identified by the melting point of 113-115°C, which was the same as that of some of the urea prepared by reaction of octadecyl amine and ODI. (The melting point of octadecyl urea has been given as 106°C (*9*) and a later preparation of the urea by hydrolysis of ODI in pyridine water solution gave a product melting at 109°C).

The above results show that water repellency is tenaciously retained under conditions which might be expected to remove dioctadecyl urea. Some reaction with the cellulose is indicated by these results.

STUDY OF REACTION CONDITIONS—ODI IN ORGANIC SOLVENTS———A considerable number of samples of cotton print cloth were treated with ODI in organic solvents (benzene and acetone were found to be equally effective) in exploratory research to determine the general conditions for application. The effect on the water repellency index of the cloth was determined by such factors as initial moisture content of the cloth, the ODI concentration, the method and conditions of curing and the after treatment. Although the data obtained are too voluminous for inclusion here, the following general observations were made:

It was found that oven-dried cloth was not as reactive nor as retentive of its water repellency as cloth which had 6-8% moisture present.

Treatment of cloth with 0.5% of ODI gave a product which was initially repellent but which lost its water repellency on extraction with acetone; however, treatment with solutions of 2% or greater ODI concentrations conferred water repellency which resisted a 6-hour extraction with acetone.

Curing could be done equally well at 140°C for 2 minutes or at room temperature for 3 days. Curing could also be accomplished by ironing the cloth with a thermostatically controlled electric iron set at the temperature for cotton (180-200°C) and this was as effective as oven curing.

In order to obtain the best initial water repellency and best retention, it was necessary to follow the curing by washing and then drying at 100°C.

The water-repellent finish obtained by solvent application resisted removal very well. Even after extraction in a Soxhlet

* The mention of trade products and firms does not imply their indorsement by the Department of Agriculture over similar products and firms not mentioned.

TABLE I

WATER-REPELLENCY OF CLOTH TREATED IN ORGANIC SOLVENT[a]

Treating Solution	Surface Tension Index (STI)[b] Initial	After drycleaning	After laundering
2% ODI in benzene	38	46	37
5% ODI in benzene	35	39	36
2% ODI in acetone	35	40	39
5% ODI in acetone	35	38	37
2% ODI in carbon tetrachloride	36	38	38
5% ODI in carbon tetrachloride	35	38	37
2% ODI in hot xylene	36	40	37
5% ODI in hot xylene	37	36	36
5% Dioctadecyl urea in hot xylene	38	42	72

[a] Kier-boiled 80-square print cloth samples were impregnated with the treating solution and ironed, washed and ironed again. Samples were ironed after laundering or drycleaning.
[b] Values of 48 and less were considered satisfactory.

TABLE II

FASTNESS OF WATER-REPELLENT POPLIN TO DRYCLEANING AND LAUNDERING

Treating Solution	Surface Tension Index (STI)[c] Initial	After no. of drycleanings 1	2	3	4	5	6	7	After no. of launderings 1	2	3	4	5	6	7
2% ODI in benzene[a]	36	39	43	48	48	56	72	72	37	38	39	40	41	43	54
5% ODI in benzene[a]	35	38	42	43	41	43	70	72	37	40	40	39	41	52	52
5% ODI in benzene[b]	35	38	38	40	43	48	68	72	36	37	37	38	39	41	42
2% ODI in CCl_4[a]	36	38	42	41	43	44	70	72	36	38	39	39	40	43	54
5% ODI in CCl_4[a]	35	37	41	41	41	45	72	70	37	39	39	39	40	42	42
2% ODI in hot xylene[a]	35	37	42	43	44	54	68	72	37	38	38	39	39	42	42
5% ODI in hot xylene[a]	34	36	39	41	43	43	52	60	37	38	38	37	38	39	40
2% ODI in mineral spirits[a]	36	41	—	48	—	70	—	72	36	—	41	—	42	—	45
5% ODI in mineral spirits[a]	36	41	—	45	—	58	—	72	36	—	38	—	41	—	42

[a] These samples were cured by ironing, then washed and ironed again.
[b] Cured at 140° C for two minutes, then washed and ironed.
[c] Values of 48 and less were considered satisfactory.

TABLE III

STABILITY OF OCTADECYL ISOCYANATE EMULSIONS TOWARD HYDROLYSIS

Composition of Emulsions[a] Carrier solvent	Duponol G gm.	H_2O ml	After prep	% ODI by Analysis Days after Preparation 1	2	3	6	7	8	12	13	14	19	20	21	28	33
25 ml benzene	1.0	75	4.7	4.0	4.4	4.5		3.8									
25 ml benzene	0.5	75	4.3	4.2	4.2			4.0				3.9			3.5	3.1	
25 ml benzene	0.2	75	4.9	5.3		5.8			5.8	5.7			5.6				5.1
25 ml benzene	0.1	75	4.4	4.4	4.4			4.3				4.4			4.3	3.9	
5 ml benzene	0.5	95	4.6	4.5	4.3			1.6				0.5					
5 ml benzene	0.1	95	4.5	4.5	4.4			1.7				1.0					
None	0.5	100	4.5	4.4	3.8			0.7				0.3					
None	0.1	100	4.4	1.6	0.5		0.4										
5 ml benzene	0.1	95	4.6	4.5	4.3		3.5		3.2		1.9						
10 ml benzene	0.1	90	4.7	4.7	4.6		4.6		4.5		4.2			2.9			
20 ml benzene	0.1	80	4.7	4.7	4.7		4.7		4.7		4.6			4.5			
25 ml mineral spirits	0.1	75	4.8	4.8		4.6				5.2							
15 ml mineral spirits	0.1	85	5.3	5.2		4.8				2.9							
5 ml mineral spirits	0.1	95	4.9	4.2		2.1				0.9							

[a] All emulsions contained 5 gms ODI, initially.

for 9 hours with acetone, and 4 hours with alcohol followed by a final laundering and drying treatment, some of the samples retained a good degree of water repellency. In many cases the water repellency was poor unless the cloth was oven dried. A similar effect has been observed with distearamidomethane *(15)*. Possibly the effect is due to swelling of the fiber. It has been shown (7) that while the surface area of dry linters fibers amounts to only 0.55 square meters per gram, that of water-soaked fibers amounts to 47.3 square meters per gram, or 86 times greater. Probably, the heating helps to melt and more uniformly redistribute the dioctadecyl urea.

Table I lists the STI's for a number of samples of cloth treated with ODI in organic solvent. Results for a sample treated with dioctadecyl urea in hot solvent are included for comparison.

Fastness to drycleaning and laundering was studied in a set of samples prepared from desized and caustic-boiled 5-oz poplin. Table II lists the results obtained.

The above samples retained their water repellency in large measure after seven launderings but had lost a considerable amount of repellency after 5 to 7 drycleanings.

An attempt was made to treat a raincoat in a manner in which it might be treated under home conditions. The coat was of 5-ounce poplin which had been laundered and dried. It was treated by soaking in 4.6% of ODI in mineral spirits, dried in the open to evaporate the solvent, cured by ironing with a hand iron, then washed and dried by ironing. The water-repellency index was 36 to 38 in the various places it was tested and approximately equal to that obtained in good commercial practice.

The stability of the ODI in mineral spirits would be of importance for practical usage. The concentrations of the solutions before and after use were determined by the Siggia and Hanna method *(17)*. They were 4.56 and 4.58% respectively. After 38 days the concentrations were 4.43 and 4.37% respectively, indicating good stability of the ODI in solution in mineral spirits.

PREPARATION OF ODI-WATER EMULSIONS——Water solutions or emulsions are preferred by textile finishers rather than solutions in flammable organic solvents, so the preparation of ODI emulsions was investigated. Hanford and Holmes *(6)* cite the use of both octadecyl isothiocyanates and ODI in soap and water emulsions to prepare water-repellent cloth. However, no mention is made of the stability of the emulsions or of any measure of the water repellency produced; the claims are made only on isothiocyanates.

In preliminary tests of a number of emulsifying agents Duponol G, a long chain alkyl sulfate, was found to be an excellent emulsifying agent for ODI in benzene solution, forming stable emulsions in water with small and uniform particle size. Cloth could be made water repellent with such emulsions and the resulting finish resisted 6 hours of acetone extraction.

A series of emulsions was prepared with varying amounts of carrier solvent and emulsifier. An initial concentration of about 5% of ODI was prepared and the change in concentration was followed by the Siggia and Hanna method *(17)* in some samples up to a period of 33 days. Table III lists the data so obtained.

The optimum range of concentrations of constituents for the maximum stability of 5% of ODI emulsions appear to be 0.1 to 0.2% of Duponol G and 20 to 25% of benzene as the carrier solvent. Mineral spirits were not as effective as benzene because emulsions prepared with the former broke after standing for two weeks. However, the emulsions made with mineral spirits could be applied to cotton with good results.

TABLE IV

WATER-REPELLENCY OF CLOTH TREATED IN AQUEOUS EMULSION

Treating Emulsion	Surface Tension Index (STI)[c]													
	Initial	After no. of drycleanings						After no. of launderings						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
2% ODI (20% benzene carrier)[a]	36	39	43	44	56	62	72	72	36	38	39	40	41	42	42
5% ODI (20% benzene carrier)[a]	35	38	39	40	43	46	72	72	37	37	37	38	39	40	41
2% ODI (20% CCl_4 carrier)[a]	36	42	—	46	—	64	—	72	36	—	38	—	41	—	42
5% ODI (20% benzene carrier)[b]	35	38	41	46	54	58	72	72	36	37	37	38	39	41	42

[a] Kier-boiled, 80-square print cloth was impregnated with the emulsion and samples were cured by ironing.

[b] Cured by heating at 140° C for 2 minutes. Samples were then washed and ironed. Samples were ironed each time after laundering or drycleaning.

[c] Values of 48 and less were considered satisfactory.

TABLE V

RESULTS OF TESTS MADE ON 5-OZ POPLIN TREATED WITH ODI EMULSION

Test	Results	Acceptable Range
Spray test	100	90-100
Slowinske rain test (2-ft level, 5 min, 80° F) Increase in weight, gms	>10 in 2 min	0.2 to 2.2 in 5 min
Hydrostatic pressure (cm)	23	39-43
Dynamic absorption (20 min) Increase in weight	16.4%	15-20%
Drop penetration Time necessary to collect 10 ml of water	46 sec	5-7 min
Bundesmann Amount of water penetration, ml	16.3 in 10 min	2-4 in 20 min
Air permeability ($ft^3/min/ft^2$) At a pressure drop o. 0.50 inch of water	24.5	

TABLE VI

WATER REPELLENCY OF TREATED 5-OZ POPLIN

Sample no.	338	339	Z-A	Z-B
Nature of sample	White poplin	Khaki poplin	White poplin	Khaki poplin
Treatment	Isocyanate	Isocyanate	SAMPC[a]	SAMPC[a]
STI (dynes)	36-37	37	36-37	37
Air permeability ($ft^3/min/ft^2$) at a pressure drop of 0.50 inch of Water	7.7	7.4	7.7	7.1
Hydrostatic pressure (cm)	22	25.3	20.5	23.9
Bundesmann (10 in H_2O retention (%)	22.6	24.0	26.9	26.2
H_2O penetration (ml)	34.4	44.7	39.7	45.9
Slowinske rain test (2-ft level, 5 min, 80° F Increase in wt (gms))	13.58	6.19	10.18	12.48
Time first spot appeared (sec)	5	53	22	20

[a] SAMPC = Commercial type stearamidomethylpyridinium chloride.

TABLE VII

WATER REPELLENCY OF TREATED 8.2 OZ COTTON TWILL

Sample no.	341	342	343	344
Treatment	5% ODI Emulsion	5% ODI in Benzene	4% SAMPC[a]	6% SAMPC[a]
Air permeability ($ft^3/min/ft^2$) (control = 34.92)	31.42	34.82	33.60	33.68
Surface tension index (dynes)	37	36	35	35
Drop penetration (time necessary to collect 10 ml of H_2O)	69.5 sec	60.5 sec	131 sec	97.5 sec
Hydrostatic pressure (cm)	24.6	25.7	24.2	24.4
Bundesmann (10 min run) H_2O retention (%)	37.6	31	24.7	24.9
H_2O penetration (ml)	223	102	7.4	4.1
Dynamic absorption (20 ml) Increase in wt (%)	40.6	24.8	30.6	29.7
Slowinske rain test (2 ft, 5 min, 80° F) Increase in wt of blotter (gm)	>10	>10	0.67	0.36
Time first spot appeared (sec)	7.5	27.5	54	100 sec

[a] SAMPC = Commercial type stearamidomethylpyridinium chloride.

STUDY OF REACTION CONDITIONS—ODI IN AQUEOUS EMULSIONS———From a large number of cloth samples treated with ODI emulsions of varying amounts of constituents, and by using different methods of cure and various aftertreatments, it was found that good water repellency was obtained from emulsions containing in excess of 2% of ODI, 0.1 to 0.2% of Duponol G and 15 to 20% of carrier solvent, such as benzene or mineral spirits. The samples could be cured by ironing, oven drying, or air drying under conditions similar to application of ODI from solvent. It was necessary to wash after curing and then dry by application of heat. In Table IV are shown some typical results. The finish obtained by application of ODI from aqueous emulsions does not resist drycleaning as well as that obtained by solvent application.

SEMICOMMERCIAL SCALE TEXTILE FINISHING WITH ODI EMULSIONS———Two applications of the ODI emulsion to 40 to 50-yard lengths of 5-oz poplin were made on standard textile wet-finishing equipment. The poor results of the first application were thought to be due to insufficient time for reaction. Better results were obtained on a second run. The cloth was padded with a 5% of ODI emulsion using 15% of mineral spirits as the carrier solvent and 0.2% of Duponol G as the emulsifier. The wet pickup was 74%. The wet material was allowed to remain at room temperature for four hours and then was partially dried by passing over steam drying cylinders and allowed to remain overnight on the roll in the semidry state. It was cured on the steam-drying cylinders, washed in hot water in a dye jig and finally dried on a tenter frame. The end pieces had STI's of 37 and 38, and the midsection, an STI of 36. Further ironing of the three pieces with a hand iron gave STI's of 36 on all three pieces. Although the STI and spray test were satisfactory, the cloth so treated would not pass the dynamic tests as shown in Table V.

The cotton cloth used above was compared with a khaki-dyed poplin cloth. Both cloths were also treated with commercial stearamidomethylpyridinium chloride in the usual manner. The results are given in Table VI. The results show that for these particular cloths there was not much difference between the commercial-type treatment and the ODI emulsion treatment.

RESULTS WITH 8.2-OZ TWILL———In order to determine the effectiveness of treating a heavier cloth with the ODI and for comparative purposes, 2-yard samples of an 8.2-oz undyed army twill were treated either with 5% of ODI emulsion or with 5% of ODI solution in ben-

zene. Comparative samples were treated with 4 and 6% of commercial stearamidomethylpyridinium chloride. Results are given in Table VII. It can be seen that the commercial type treatment is better, particularly in those cases involving dynamic forces.

CONCLUSIONS AND SUMMARY

Cotton cloth may be made superficially water resistant by the use of 2 to 5% of octadecyl isocyanate in either organic solvents or aqueous emulsions, if the carrier liquid is evaporated and the treated fabric is then cured with heat, washed, and dried with heat. The finish so obtained is fairly resistant to both solvent removal and to laundering. The "Spray Rating" or "Surface Tension Index" of the treated cloth is good but the water repellency fails when it is tested under dynamic water repellency tests. It was concluded that the treated cloth is "shower resistant" but the finish would not be suitable for use in heavy rainstorms. The extent of isocyanate esterification with the cellulose was not determined. Apparently, a large part of the water repellency is due to the formation of the very insoluble dioctadecylurea by hydrolysis of the isocyanate.

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We are indebted to Ruby K Worner and Janice M Poynot for some of the water repellency test data, and to Jane Warren for the nitrogen determinations.

LITERATURE CITED

(1) *Technical Manual and Yearbook of the American Association of Textile Chemists and Colorists* 28, 136-137 (1952).

(2) American Society for Testing Materials, "ASTM Standards on Textile Materials", Philadelphia, 1952, ASTM Designation D583-52T.

(3) Dahlen, Miles A and Pingree, Raymond A, "German Chemical Developments in Improving Water Resistance of Textiles", US Off Publication Board Rept *PB-1576*, p 10 (1945).

(4) Hanford, William E and Holmes, Donald F, (to Du Pont), Brit Pat 571,975 (Sept 18, 1945).

(5) Georges, Louis W and Hamalainen, Carl (to United States of America, as represented by the Secretary of Agriculture), US Pat 2,428,843 (Oct 14, 1947).

(6) Hanford, William E and Holmes, Donald F (to Du Pont), US Pat 2,284,895 (June 2, 1942).

(7) Hunt, Charles M, Blaine, Raymond L and Rowen, John W, *J Research NBS* 43, 547 (1949).

(8) I G Farbenindustrie Aktiengesellschaft, Brit Pat 461,179 (Feb 8, 1937).

(9) I G Farbenindustrie Aktiengesellschaft, French Pat 809,233 (Feb 26, 1937).

(10) Kaase, Walther and Waltmann, Ernst (to Heberlein Patent Corp), US Pat 2,303,363 (Dec 1, 1942).

(11) Kaase, Walther and Waltmann, Ernst (to Heberlein Patent Corporation), US Pat 2,370,405 (Feb 27, 1945).

(12) "Isocyanates", *Monsanto Technical Bull* P-125, p 11 (April 1, 1948).

(13) Petersen, Siegfried, *Ann* 562, 205 (1949).

(14) Schirm, Erik (to Heberlein Patent Corp), US Pat 2,303,364 (Dec 1, 1942).

(15) Schuyten, H A, Weaver, J W, Frick, J G, Jr, and Reid, J D, *Textile Research J* 22, 424 (1952).

(16) Schuyten, H A, Weaver, J W, and Reid, J D, *Am Dyestuff Reptr* 38, 364 (1949).

(17) Siggia, Sidney and Hanna, J Gordon, *Anal Chem* 20, 1084 (1948).

(18) "Tentative Textile Standard", Nos. 7 and 8, 1947, *J Textile Inst* 38, S1-14 (1947).

• PATENT DIGEST •

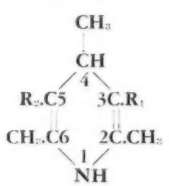
PAUL WENGRAF

OPTICAL BLEACHING (BRIGHTENING) AGENTS ——Dihydrocollidine Derivatives B, 5

U S Pat 2,661,305
(L B Holliday & Co——Appleton, Kiehl——Dec 1, 1953)

Many compounds that are fluorescent under the influence of short-wave light have been proposed for imparting optical bleaching (brightening) effects. The best known classes are coumarine derivatives, particularly β-methyl umbelliferone, derivatives of diamino stilbene disulfonic acids, optionally condensed with triazines (e g, the "Avitex" brands), and so on.

It has been discovered that another group, based on the structure of substituted dihydrocollidine, can be applied for the same purpose; the effect is said to surpass in many cases even that of known brightening agents. Dihydrocollidine (trimethyl dihydro pyridine) is the basis for these compounds. The appropriate derivatives are dicarboxylic acid esters of dihydrocollidine of the formula



wherein R_1 and R_2 are dicarboxylic ester groups, e g, $COOC_2H_5$. Various other alkyl- or aralkyl groups as well as amidoester groups can be used as substituents. These compounds are sparingly soluble or insoluble in water and have to be dispersed by one of the known methods, for instance, by Nekal, sulfite waste liquor, soap or the like. Combining these agents with usual bleaching or reducing substances is within the scope of this invention.

Among the references cited by the Patent Office:

U S Pat 2,468,431 (Am Cyanamid/1949): alkoxybenzoyl derivatives of diamino stilbene disulfonic acids are suggested as optical bleaching agents.

Brit P 522,672 (Meyer/1946): substances of the coumarine group, especially methylumbelliferone, are proposed as brightening agents.

U S Pat 2,341,009 (Richards Chem Works/1944): incorporating into textiles, leather, etc, small amounts of photoluminescent substances that are characterized by the emission of certain light waves under visible light; these substances are selected to compensate the wave length of rays emitted by reflection. This patent enumerates various plant extracts and synthetic compounds corresponding to these conditions; pyridine derivatives are not mentioned.

The annual index to the Patent Digest will appear in the August 2nd issue

ABSTRACTS

Optical and Electron Microscopic Studies of Cotton Fiber Structure

M L Rollins and V W Tripp, *Textile Research J 24*, 345-57, April, 1954.

In spite of the tremendous growth of the synthetic fiber industry in recent years cotton still holds 71 percent of the world's fiber production market. It is the most versatile of textile materials, and the most widely used, but although its commercial utilization dates back into antiquity, its properties and characteristics are still not completely known.

As in the case of most natural products, empirical methods of handling, developed through the ages, still govern modern technological procedures to some extent. Even in the advanced state of our knowledge with respect to physical and chemical phenomena, there are still small areas of ignorance which continue to impede our progress in the improvement of natural products to meet modern needs. The same "miracle" processes which have produced the synthetic competitors of cotton could, it is believed, be used to impart to cotton some of the properties which have given to the synthetics specific advantages in specialized fields. To this end, it is imperative that we understand more thoroughly the morphological and structural features of the cotton fiber itself.

Much of what is known about the appearance, structure, and properties of the individual cotton fiber is the result of microscopical investigations extending over a period of approximately 100 years, in which the most significant advances have come within the past three decades.

Two types of microscopes are now in fairly common use: the ordinary light microscope, for which the limit of useful magnification is about 1000, and the electron microscope which can magnify up to 20,000 times directly, but has sufficiently high resolution that the image obtained at 20,000 can subsequently be enlarged photographically to a magnification of 100,000. This instrument, in use for only about 15 years, has already permitted investigations of structure on an entirely different level, and having only recently extended our knowledge of the structure of natural fibers, promises to contribute materially to our understanding of their behavior during processing treatments.

The authors describe in detail an investigation which they have made of growth and development of the cotton fiber, using both types of microscope and also occasionally the polarizing microscope as well. The paper is illustrated by a large number of photomicrographs and electron micrographs.

Eighteen references are made to the literature.—WHC

Improving the Dyeing Properties of Polyester Fibers

J A Somers, *British Rayon Silk J* 30, #357, 56-7, February, 1954.

With regard to its physical properties, such as strength, extensibility, resilience and resistance to creasing, and general inertness towards deteriorating influences, Terylene (the one polyester fiber at present of interest) has very great technical significance. But to the dyer this fiber (equivalent to Dacron) presents difficulties.

Terylene fibers are built up of long, relatively straight molecules of polyethylene terephthalate, and these molecules have a configuration which facilitates their close packing parallel to the length axis of the fiber. The important fact in this connection is that the very compact structure of Terylene fibers is an advantage because it underlies the high strength of the fibers and makes them resistant to deteriorating influences; but it is also a disadvantage since, while this compactness prevents the penetration of destructive chemicals and microorganisms, it also hinders penetration by dyes.

It is thus common experience among dyers of Terylene that it is difficult, except with a limited number of dyes, to obtain a high degree of exhaustion of the dye liquor and to produce really deep shades. Experimental evidence shows that, after a layer of dye particles has been attracted or attached to the surface of a polyester fiber, it takes a very long time for these dye particles to diffuse into the interior. By prolonging the dyeing and making the dyeing conditions more drastic, e g, by using a dyeing temperature of 120° C or more, the dye can be induced to advance towards the center of the fiber, so that ultimately a more uniformly colored cross-section results.

The author mentions several methods that have been proposed for speeding up the dyeing process. One method consists of treating the fibers so that they become uniformly more porous or less compact in structure; e g, by adding to the dyebath fiber-swelling agents, such as metacresol or orthochlorophenol. Such additions can, however, induce shrinkage and weakening of the fiber. A pretreatment with sulfuryl chloride gives an increased affinity for disperse acetate dyes, and a short treatment in a hot concentrated sodium sulfide solution has a similar effect, but too drastic treatment will tender the fiber. Zinc chloride and lithium bromide also have been used as pretreatments, but are subject to the same danger.

Finally, the author suggests that, if small substituent groups were introduced into the terephthalic acid molecule, the fibers should not be so closely packed, and penetration by the dye liquor would be improved.—WHC

The Heat Setting of Terylene Polyester Filament Fabrics in Relation to Dyeing and Finishing

D N Marvin, *J Soc Dyers Colourists* 70, 16-21, January, 1954.

Terylene yarn, in an unrestricted state, shrinks in boiling water about 7 percent. The higher the temperature to which the yarn or fabric is exposed, the higher the resultant shrinkage. It is therefore necessary to stabilize Terylene fabrics before they are made into garments, in order that they may retain their shape on washing and ironing.

The process of stabilization, or heat setting, as it is termed, consists essentially in exposing the fabric, while under dimensional control, to a temperature higher than any likely to be met with in its subsequent history.

The author first discusses the use of dry heat. If, for example, a fabric is required to be made dimensionally stable at temperatures up to and including 150° C, this can be achieved by setting the fabric at a temperature of 180° C. Similarly, a fabric may be stabilized at 175° C if it is set at 200° C.

The effect of setting a Terylene fabric is to decrease the amount by which it creases on boiling, and furthermore, the higher the setting temperature, the less the creasing. The setting is accompanied by a harshening or stiffening of the fabric, which detracts from its hand and draping qualities. The author states, however, that these qualities may be restored by a simple handwashing. As regards dyeability, it is stated that the dye uptake of fabrics set at temperature from 120° to 230° C decreases at first with increased setting temperature, but increases above 220° C.

Terylene filament fabrics, unlike those made from nylon, cannot be stabilized to elevated temperatures by low-pressure steam or boiling-water treatments. Although these fabrics may be effectively

stabilized by high-pressure torpedo steaming, this method of setting is not recommended, since it causes a degradation of the fiber.

The author discusses various types of setting machinery, including the use of radiant heat. He states that Terylene fabrics may be set at any one of three stages———before scouring, after scouring but before dyeing, or after scouring and dyeing. There are obvious advantages in setting at the earliest stage in processing, since subsequent wet operations will help to "break down" and restore the handle of the set fabric. Furthermore, wet creasing and shrinkage will be minimized and the curling of knitted fabrics reduced.—WHC

The Textile Trade and the Newer Fibers

F H Clayton, *J Soc Dyers Colourists* 70, 7-13, January, 1954.

The author presents statistics showing the growth in the production of the natural fibers between 1800 and 1900, and of both natural and synthetic fibers from 1900 to the present.

He classifies the synthetics in ten groups according to their chemical composition, and gives a list of the major properties and typical end-uses, both household and industrial, of five of these classes (polyamide, polyester, polyvinyl, polyethylene, and regenerated protein).

He gives the comparative prices of all the fibers, both natural and synthetic, as of April, 1952, and points out that the man-made fibers have varied little in price over the past five years, compared with the natural fibers, especially wool and silk.

Other tables show the planned world production of the various synthetics; the relative consumption in the USA of both natural and man-made fibers from 1930 to 1952; and the consumption per capita of textile fibers in the USA in 1949, broken down into men's and boys' wear, women's and misses' wear, children's and infants' wear, household, and industrial uses.

Some people in the textile industry, according to the author, are antagonistic to the new fibers. The real position, in his judgment, is that there is no real "battle of the fibers", but what is really happening is "the greatest revolution in the industry since the Industrial Revolution". He says, "We are dropping the barriers and hurdles which divided cotton from wool, the wool industry from the silk industry, and so on, and now can talk and think and work for the first time in the *textile* industry". He cites in illustration a fabric containing 25% cotton, 25% viscose, 30% acetate, and 20% nylon, and another containing 60% wool, 15% viscose, 15% nylon, and 10% acetate.

He urges the importance of learning as soon as possible the essential properties of all the textile fibers available, so as to give the ultimate customer the best possible article at the most economical price. —WHC

Hydrophilic Synthetic Fibers

Anon, *Dyer* 111, 51, 53-4, January 8, 1954.

The regenerated fibers, viscose and cuprammonium (cellulosic) and Ardil, Vicara, and Lanital (protein) are hydrophilic; all have high moisture content, high affinity for dyes, and a ready ability to absorb sweat.

Of the synthetic fibers, only three, nylon, Perlon, and Vinylon, have moisture regains higher than 1 percent. All the others, Terylene, Dynel, the acrylates, and the PVC fibers, have moisture regains less, and usually very much less, than 1 percent. In effect, these fibers and their physical properties are unaffected by water; are as strong wet as dry; are extremely difficult to wet out and to dye; do not swell in aqueous liquors; will not absorb perspiration, and are characterized by a very high degree of resistance to biological and chemical attack.

The author claims that such fibers are suited, not for traditional textile purposes where kindliness to the skin and warmth, comfort, and moisture absorption are required, but for a quite new set of uses which could never be properly, if at all, met by the natural fibers: e g, various industrial uses, such as filter cloths, marine cordage, etc.

The extreme lowness of the affinity of most of the synthetic fibers for moisture has brought endless dyeing troubles, and all sorts of devices have had to be introduced in order to color the new fibers (dyeing above 212° F, the use of cuprous ion and "carriers", etc). Only nylon and Perlon can be dyed by the traditional methods of dyeing.

These hydrophobic synthetics have been of immense value and interest; they have demonstrated that fibers can do things in conditions under which no natural fibers could survive. They have opened up new uses for textiles. But by and large, the author claims, they will never be suitable for traditional textile applications by themselves; most of their properties are absolutely unsuitable. But blends with other fibers may be of immense importance.

To equal the warmth, high moisture absorption and high affinity for dyes possessed by the natural fibers, the author maintains that new fibers must be synthesized, with plenty of polar groups and side-chains. Numerous hydroxyl and amino groups are desirable; then the fibers will have high regain and will dye easily from aqueous baths at normal temperatures.

The author calls attention to the Japanese fiber, Vinylon or Kuralon, which has a moisture regain of 5 percent, and states that this is a fiber to watch, being both hydrophilic and cheap.—WHC

Investigations to Determine the Effects of the Washing Temperature and Time and the Concentration of the Washing Agents when Washing by Machine

S. Koehler, *Textile Research J* 24, 173-96, February, 1954.

The object of this investigation was to determine the effects of the maximum temperature, the time, and the concentration of washing agents on the detergent action of the washing and on the reduction of the tensile strength and of the weight of bleached cotton and linen fabrics.

The increase in the whiteness of cotton fabric stained with soot, paraffin oil, and tallow, with ultramarine, and with claret after three washes was used as a measure of the detergent action. The reduction of the tensile strength and of the weight of cotton and linen fabric was determined after 50 and 100 washes, and in some cases after 10 and 25 washes as well. The ash content and the whiteness of the washed pieces of fabric were determined after 50 and 100 washes.

Soap made of fatty acids with a titer of about 40° C was used for the washing tests, except in special cases with low-titer soap made of fatty acids with low and high iodine values, respectively. Of the common alkalis, sodium hydroxide, sodium metasilicate, trisodium phosphate, sodium carbonate, and sodium sesquicarbonate were used.

The main results of the investigation were as follows:

Increasing the maximum washing temperature from 65° to 95° C resulted in a continuous increase of the detergent effort. Increasing the time from 2 to 30 minutes had the same effect.

An increase of the soap concentration over and above that required for the dispersion of the dirt does not appreciably improve the detergent effect. A distinct lathering of the soap solution in the machine is usually an indication that the soap concentration is adequate.

Certain types of dirt, e g, soot, are more easily removed with a lower concentration of alkali than with a higher one. Other impurities, e g, colored organic matter, are more easily removed with a high alkalinity soap. As a rule,

about 1 g NaOH, about 3 g $Na_2SiO_3.5H_2O$, about 4 g $Na_3PO_4.12H_2O$, or about 3 g Na_2CO_3 per kg wash goods is sufficient. A high CO_2 content in the water may require a larger amount of alkali.

The pH value can be used to check the alkalinity of the liquor. For ordinary white goods the pH value of the wash liquor should be between 10.5 and 11, measured at 20° C.

At a total washing time of 30 minutes, 10 minutes of which was at maximum temperature, the tensile strength of cotton fabric was reduced by about 15 percent, and that of linen fabric by about 25 percent after 100 washes, irrespective of the maximum temperature within the range 65° and 95° C.

The washing tests with low-titer soaps made of fatty acids with low and high iodine values, respectively, indicate that soap made of fatty acids with a high iodine value does more damage to cotton and particularly to linen than does soap made of fatty acids with a low iodine value.

Numerous tables are included, showing the effect of time, temperature, and alkalis on the degree of whiteness, reduction in tensile strength and weight, etc. Nine references to the literature are cited.—WHC

Textile Fiber Consumption

Anon, *Textile Organon* 25, 40-4, March, 1954.

Apart from 1950 and 1951, 1953 was the best year for United States total fiber consumption since the war-time year of 1943.

The following figures, taken at intervals from a table in the *Organon*, show the mill consumption of cotton, wool, rayon-acetate, other fibers (synthetics), and silk, and the total of all fibers, for the years 1920, 1930, 1940, 1950, and 1953. The author explains that "mill consumption" means "the use of yarn or raw fiber by all U S mills, although the exact point of measurement varies somewhat for the different fibers".

Reviewing the 34-year period covered by this table, some significant changes may be observed. Thus, the consumption of cotton, which was 88.9% of total fiber consumption in 1920, had dropped to 69.3% in 1953. A similar decline took place in wool consumption, on a percentage basis. However, the *actual* consumption of both cotton and wool increased by over 50% during the period. Meanwhile, the total consumption of all fibers was more than doubled, due to the steady increase in the population and the rising standard of living.—WHC

Millions of Pounds

Year	Cotton	Wool	Rayon-Acetate	Other	Silk	Total
1920	2828.1	314.2	8.7		29.2	3180.2
1930	2610.9	263.2	118.8		75.6	3068.5
1940	3953.6	407.9	482.0	4.4	35.8	4883.7
1950	4680.1	647.0	1351.4	140.6	8.4	6827.5
1953	4520.7	488.8	1223.0	283.6	5.4	6521.5

Fluorescence and Textiles

A E Williams, *Textile Mercury & Argus* 130, 321, 323-4, February 19, 1954.

When exposed to ultra-violet rays, from which visible light has been removed by a suitable filter, many substances fluoresce in colors which are characteristic for the material. This property often serves to differentiate grades of the same substance, to detect adulteration or admixtures. In some cases substances which are invisible in ordinary light may be seen in detail by their fluorescence.

In the textile industry ultra-violet rays are used in connection with dyeing processes, for fiber examination, controlling sizing, etc. Small differences in shades of color which go unnoticed in normal lighting are quickly detected when irradiated with an ultra-violet lamp. Mixed dyes, perfectly uniform in appearance in ordinary light, often show up as mixtures under the rays. Spots of oil that would interfere seriously with dyeing or bleaching may be detected. Soledon and Indigosol dyes on wool exhibit an intense fluorescence which disappears when the leuco dyestuff is completely oxidized to the normal vat dye.

By placing a highly fluorescent, but chemically inert, agent into colorless printing pastes, such as Soledon, Indigosol, or Rapid Fast colors or discharge pastes, the occurrence of scumming, snaps, bad fitting, etc, can be made visible under an inspection fluorescent lamp and valuable time and materials saved.

Ultra-violet radiation permits all types of fibers to be easily differentiated, particularly if a staining technique and the microscope are used. Vegetable fibers usually show a yellow fluorescence, changing to dull violet on scouring or bleaching, but on long aging, to a dull tone of yellowish white. Scouring animal fibers brings up a bright blue fluorescence. Jute appears as bright bluish violet, but after extraction with petroleum ether this fiber is inert under the lamp; it is the only fiber which exhibits this feature, the violet fluorescence being transferred to the petroleum ether. Marked differences in fluorescence colors occur with Lanital and wool, also Cisalfa, Fibramine, immunized wool, Rhodiaceta, and copper-silk

The fluorescent lamp is also employed in the detection of mildew on cotton fabrics. Rayon fibers are dulled with various agents during processing, and some of these agents exhibit brilliant luminescence. Imitation Egyptian cotton may be distinguished from genuine by its stronger fluorescence.

A number of metallic compounds, such as zinc chloride, alum, etc, present in sizes and finishes are readily detectable when using the lamp. Certain synthetic resin finishes may also be identified.

Some laundries now use a colorless, highly fluorescent marking ink for identification purposes; the clothes then being sorted under ultraviolet rays.—WHC

Acrilan———The Acrylic Fiber, and Blends

J A Woodruff, *Canadian Textile J* 71, 78-80, January 29, 1954.

Acrilan is a polymerized acrylonitrile fiber which has been modified by the introduction of other polymeric ingredients. These modifications have resulted in the improvement of the textile dyeing properties of the material. Acrilan is manufactured as staple in either 3 or 5 denier per filament, with or without delustrant.

The fiber is a light cream color, which turns yellow to orange to brown on prolonged heating at elevated temperatures. The moisture regain at 58% R H is 1.5-1.7%. The mildew resistance is excellent. The thermal insulation is about the same as wool.

For dyeing Acrilan, one most often uses those dyes normally used for wool. Other dyes are classified as follows:

Direct acetate dyes are sometimes used but have rather poor fastness properties. The developed acetate blacks and navies are quite good in fastness and find some practical use. The sulfuric acid esters of vat dyes offer considerable promise in dyeing light to medium shades on staple fiber and yarns. Vat dyes themselves so far have been seldom used, but at temperatures around 240° F in package dyeing good results can be obtained.

The writer mentioned that the use of the cuprous ion technique is not necessary in dyeing Acrilan. Neither is high-temperature dyeing necessary, although the dyeing process can be hastened by temperatures from 230° to 240° F.

In most cases the dyeing is followed by a light scour. The need for the final scouring is governed by the depth of shade of the dyeing and the type of dye used. The scouring agent may be either nonionic or anionic.

Typical formulas for dyeing Acrilan with acid, Algosol, top-chrome, acetate, and premetallized dyes are included; also dyeings of blends of Acrilan and viscose and Acrilan and wool.—WHC

Proceedings of the
American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

JULY 19, 1954

AATCC CALENDAR

COUNCIL
1954—Sept 15, Nov 19.
1955—Jan 21, Apr 15, June 17

NATIONAL CONVENTIONS
Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (New York); 1957 (Boston).

NORTHERN NEW ENGLAND SECTION
Oct 8 (Colonial C C, Lynnfield, Mass); Dec 10 (Woodland Golf Club, Auburndale, Mass).

PACIFIC NORTHWEST SECTION
July 24 (Outing, Mt Hood Golf Club).

PIEDMONT SECTION
Oct 16 (Hotel Barringer, Charlotte, N C).

PHILADELPHIA SECTION
Sept 24, Oct 29 (Penn-Sherwood Hotel, Philadelphia, Pa); Dec 3 (Kugler's Restaurant, Philadelphia).

RHODE ISLAND SECTION
Oct 14 (Johnson's Dummocks Grille, Providence, R I); Dec 2 (Annual Meeting—Sheraton Biltmore, Providence, R I).

SOUTH CENTRAL SECTION
Dec 4 (Hotel Patten, Chattanooga).

SOUTHEASTERN SECTION
Dec 11 (Atlanta-Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
Oct 1, Nov 12, Dec 10 (Rapp's Restaurant, Shelton, Conn).

(A general calendar of events may be found page 484)

E E Fickett

ELMER E FICKETT, head of the Department of Chemistry, Lowell Technological Institute, has retired after 37 years as a member of the LTI faculty.

Prof Fickett, an AATCC Councilor, was honored with a testimonial dinner on June 10th at the Rex Grille in Lowell, Mass, which was attended by over 150 friends and associates. In addition numerous telegrams were received from his many friends throughout the country.

Charles F Edlund, LTI dean, served as master of ceremonies, and Roland E Derby brought greetings from the Lowell Tech Alumni Association. President Martin J Lydon, in presenting a gift, told of Prof Fickett's many contributions to industry and education.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Technological Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

54-14

Education: B Chem Eng.
Experience: textile chemist and engineer, technical sales service and research.
Age: 37; married; references; New England preferred.

7-5, 7-19

54-15

Education: textile school, evening classes.
Experience: textile mill chemist, woolen and worsted.
Age: 56; married; references; position in eastern U S desired.

7-5, 7-19

54-16

Education: BS, home economics & textile chemistry, graduating 1954.
Experience: playground instructor and clerk during college vacations.
Age: 22; woman; unmarried; references; position as textile chemist desired; location not restricted.

7-5, 7-19

Monograph No. 2
"THE APPLICATION OF VAT DYES"

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeing and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer *must* have access to this volume."—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

"This book . . . is abreast of the latest technical developments and research. Its value is increased because of the lack of books in this field today . . . we can readily recommend this book to all technical and practical men"—*MELLIAND TEXTILBERICHTE* (Germany).

"This monograph contains the work of many mill-experienced authors, plus good, sound chemical and application principles developed in the laboratories and mills enjoying AATCC membership. . . . This book puts between two covers much information that a dyer is constantly searching for. It is a good investment for any laboratory, dyehouse, or printshop."—*TEXTILE WORLD.*

". . . this monograph should be in the hands of every user of vat dyestuffs, every student and every teacher. The book is well indexed and includes valuable lists of equivalent trade names. It will certainly take its place as a standard book of reference."—*JOURNAL OF THE SOCIETY OF DYERS AND COLOURISTS* (England).

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1954 National Convention and "The South's First Textile Wet Processing Exhibit"——

SPONSORED BY THE SOUTHERN REGION ★ THE ATLANTA BILTMORE ★ ATLANTA, GEORGIA ★ SEPTEMBER 15, 16, 17, 18

An Open Letter

FROM THE REGISTRATION COMMITTEE

1954 Convention Registration Committee

Standing: David Meriwether (left) and John K Boykin. Seated: A Kempton Haynes, *chairman*

WE OF THE Registration Committee look forward to a large attendance at the 1954 Convention and, to make it easy for all, we have sent advance registration envelopes to the membership. You may register and select the events you desire to attend in advance, and upon your arrival at the convention, your advance registration envelope containing all selected tickets and badge will be ready. As space at some of the events is limited, it is urged that you notify us of your ticket requirements as early as possible.

The Hotel Reservation Committee is requiring registration fees for each person desiring room accommodations in advance of room assignment. Be sure to include your hotel reservation card inside your registration envelope with a fee for each occupant of the room along with the names of the occupants.

For those wishing to sit together in groups at the Georgia Tech-Tulane football game, it will be necessary for one person from each group to order all the tickets and enclose the total cost in his registration envelope. We have a block of very good seats available to August 18th—so get your order in early!

To assure that we have everything taken care of on your arrival:

1) Give complete information on the registration-reservation reply envelope.

2) Enclose check or money order for the total amount to cover *registration* and *events* you plan to cover. Make checks payable to "1954 National Convention, AATCC."

3) Give complete information on hotel reservation card.

4) If you plan to have a lady guest, be sure to include the registration fee of $5.00 for the ladies program, and show her name on the registration-reservation reply envelope.

5) Mail AT ONCE in the addressed envelope
   a—registration-reservation envelope
   b—your check or money order
   c—hotel reservation card
   d—special activities card

6) Unavoidable cancellations may be made up to September 11 by notifying the Registration Chairman at AATCC Headquarters, Atlanta Biltmore Hotel, Atlanta, Ga. Refunds will be made by money order.

7) Tickets for meals will not be available without registering.

We are looking forward for y'all to come South and enjoy a fine convention with us.

REGISTRATION COMMITTEE
A Kempton Haynes, *chairman*
John K Boykin, *asst chairman*
David Meriwether, *asst chairman*

TRANSPORTATION

THE Transportation Committee, headed by Chairman Wyss L Barker, National Aniline Division, Allied Chemical & Dye Corp, is actively promoting special trains and planes to and from Atlanta for the '54 convention.

A special train will leave New York the afternoon of Sept 14, arriving in Atlanta the following morning in time for the Council meetings, and will return leaving Atlanta about noon on Sunday, Sept 19. The train will have cars from Boston, northern New York, and other points as required, and it will pick up additional cars as needed at Philadelphia, Washington, Danville, Va, and Charlotte, N C. Additional service and extra cars will be provided from Chicago and the West Coast as required. All reservations should be made directly with the railroad you plan to use.

Special planes will be provided from Boston, New York, Philadelphia, Chicago and the West Coast where needed. All reservations should be made with the airlines well in advance.

The Transportation Committee will provide buses which will shuttle between the various convention hotels and the headquarters at the Atlanta Biltmore during the convention. Buses will also be provided to meet the special trains coming from the north. Special buses will be provided for the ladies luncheon at the Capital City Country Club on Thursday, for sightseeing trips on Friday afternoon, for the Saturday afternoon football game, and for the golf tournament.

TRANSPORTATION SERVING ATLANTA

RAILROADS: The City is served by eight great railway systems and by fifteen main lines which produce ninety-two passenger train schedules daily. The systems and number of lines are: Atlantic Coast Line—1; Georgia Railroad—1; Atlanta and West Point Railway—1; Central of Georgia—2; Louisville and Nashville Railway—1; Nashville, Chattanooga & St. Louis—1; Seaboard Air Line Railway—2, and Southern Railway System—5.

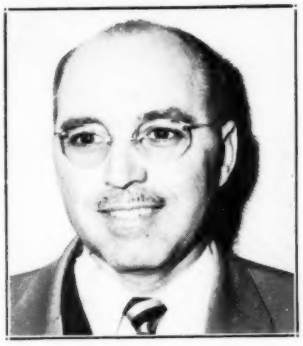
Arriving trains include eight from New York, eight from Chicago, four each from Birmingham and New Orleans, and three from Washington. Departures include nine trains daily to New York and eight to Chicago.

Atlanta has two train depots, the Terminal and Union Stations. Each is centrally located and within the minimum cab fare of most principal hotels.

AIR LINES: The air transportation center of the south, Atlanta is served by 214 planes in and out each day. Twelve major air routes terminate here: (1) New York; (2) Chicago; (3) Dallas-Los Angeles and Trans-Pacific; (4) New Orleans-Mexico City and South America; (5) Miami-Central and South America; (6) Tallahassee-Tampa; (7) Charleston; (8) Cincinnati; (9) Savannah; (10) Pittsburgh-Buffalo; (11) Kansas City; (12) Denver.

Lines serving the city include Eastern, Delta-C&S, Capital and Southern. The Atlanta Municipal Airport is located nine miles southwest of the city. Limousine service is provided by the Atlanta Baggage and Cab Company. Fare to downtown ticket offices and leading hotels is $1.15, federal transportation tax included.

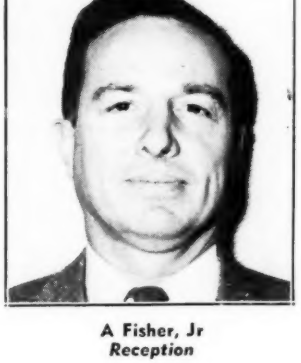
BUSES: Atlanta is served by Greyhound, Modern Trailways, Service Stages, Smoky Mountain Trailways, Southeastern Etages and Tennessee Coach Lines. These bus lines maintain 320 arrivals and 320 departures each day.



A K Haynes
Registration

W L Barker
Transportation

J M Smith
Printing



A Fisher, Jr
Reception

RECEPTION

THE Reception Committee, headed by Adam Fisher, Jr, E I duPont de Nemours & Co Inc, *chairman*, and M B Eubanks, Jr, Riegel Textile Corp, *vice chairman*, will maintain an information center adjacent to the registration desk at the convention headquarters in the Atlanta Biltmore.

Members of the Committee request that you stop at the desk to exchange greetings and afford it them an opportunity to be of assistance in rendering any information regarding convention functions as well as local activities. From them you may obtain further information relative to "outside" entertainment and points of attraction in and around Atlanta, and also find out where other members and guests are located. The Committee will have available a current list of all registrants showing their hotels, and will relay messages. A telephone service will also be available at the desk to enable you to call the reception desk directly, should any questions arise when you are away from the headquarters hotel.

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PRINTING

UNDER the chairmanship of Junius M Smith, Clark Publishing Co, the Printing Committee for the forthcoming Atlanta Convention is tackling the job of printing the various letterheads, envelopes, floor plans of the exhibit hall, registration, reservation forms, official convention programs, menus, banquet tickets, etc. Mr Smith is being assisted by Robert D Sloan, E I duPont de Nemours & Co, Inc, and James T McAden, Jr, Clark Publishing Co.

All advance printed matter is completed, and a 4-page folder giving detailed information about the convention as well as five other pieces of literature (registration, reservation reply envelopes, hotel reservation forms, etc) are in the mail. The official convention program, menus, banquet tickets, and other printed matter will be completed about the middle of August.

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EXHIBITS

THE exhibits Committee, headed by John C Cook, WRC Smith Publishing Co, is comprised of the following members: Roger W Moister, Wyandotte Chemicals Corp; Richard C Davis, Armour & Co; and Warren K Cooley, Caled Products Co, Inc.

A detailed review of this committee's activities will appear in the August 2nd issue.

SYMPOSIUM ON SHRINKAGE*

I. COTTON-FABRIC SHRINKAGE AND ITS CONTROL

LEONARD S LANG

Cluett, Peabody & Co, Inc, Troy, N Y

The reasons for the shrinkage of cotton fabrics as formerly finished are discussed. The shrinkage problem was especially troublesome for the manufacturer of laundered collars. Several attempts at eliminating this difficulty were made by preshrinking, by providing shrinkage allowances, or by special spinning and weaving procedures. None of these early expedients was satisfactory. A personal investigation, in 1927, of the shrinkage problem by Sanford L Cluett, then director of research for Cluett, Peabody & Co, Inc, resulted in the first successful controlled-shrinkage process. This original method was based on an overfeeding device attached to a pin tenter. Because of various inherent faults with this procedure, Mr Cluett developed an entirely new and novel solution to the shrinkage problem by means of the compressive-shrinkage principle. The complete operation of a compressive-shrinking range is described in detail. The latest improvement in this process whereby a thick rubber belt is substituted for the original felt belt is also described.

INTRODUCTION

THIS evening I am going to describe to you the causes and practical cure of shrinkage in cotton fabrics. Webster's dictionary says that *to shrink* is *to contract in extent.* If we mark off a certain distance, for example 18 inches, along the warp direction of a piece of bleached and finished unshrunk cotton goods and then wash and press it on a flat-bed press, we observe that the distance between these marks has diminished by a certain definite amount, for example 1 inch. Now, if we were to fray out the yarns until we came to one of the warp yarns that we had marked, then carefully remove it from the fabric and place it on a yardstick, we would have no trouble at all in applying enough tension to restore the marks to their original 18-inch dimension. What happened to the original fabric when it was laundered? The washing allowed the warpwise tension caused by weaving and finishing to relax, thus increasing the sinuosity or crimp of these yarns. Likewise, the same principle holds good for fillingwise shrinkage.

However, the fact that a single yarn can be stretched back to its original length is of no help to the woman whose cotton dress had shrunk excessively or to the man whose laundered collar is choking him.

The shrinkage problem on cotton fabric began with the mechanization of spinning, weaving, bleaching and finishing.

The textile industry, whose earliest beginnings reach back to the dawn of recorded history, was the center of the great industrial revolution of the late Eighteenth Century. The inventions of the flying shuttle, spinning jenny, spinning frame and the cotton gin laid the foundation for the modern textile industry. In 1814 the first power-driven looms were developed in New England. Additional improvements and new inventions served to increase greatly the number of cotton mills and their output.

Following closely on the rapid development of textile manufacturing, the demand for bleached and dyed fabrics likewise grew. Printing and dyeing plants were established as early as 1812. By 1837 the calico bleaching process had been introduced. This included the following operations, which were performed on fairly large lots of goods sewed together into long continuous lengths: singeing, gray washing, lime boiling under pressure, neutralization with weak acid, boiling with rosin soap under pressure, boiling with soda ash under pressure, treatment with a solution of bleaching powder, souring, rinsing and drying. The custom of handling the fabric in long continuous pieces as well as can drying and heavy calendering resulted in excessive warpwise tensions, which left the finished goods with high residual shrinkage.

This, then, was the type of goods supplied to the cotton garment industry for many years. As a result, shrinkage had long been recognized by the textile, garment and laundry industries as a difficult and puzzling problem. The starched-collar manufacturer generally using cotton fabrics was especially concerned with shrinkage. Every new collar had to be thoroughly washed for as long as four hours. When fully laundered, such a popular item of men's wear of a generation ago carrying a stamped size of 15 might actually measure anything from 14½" or less to 15½" or more.

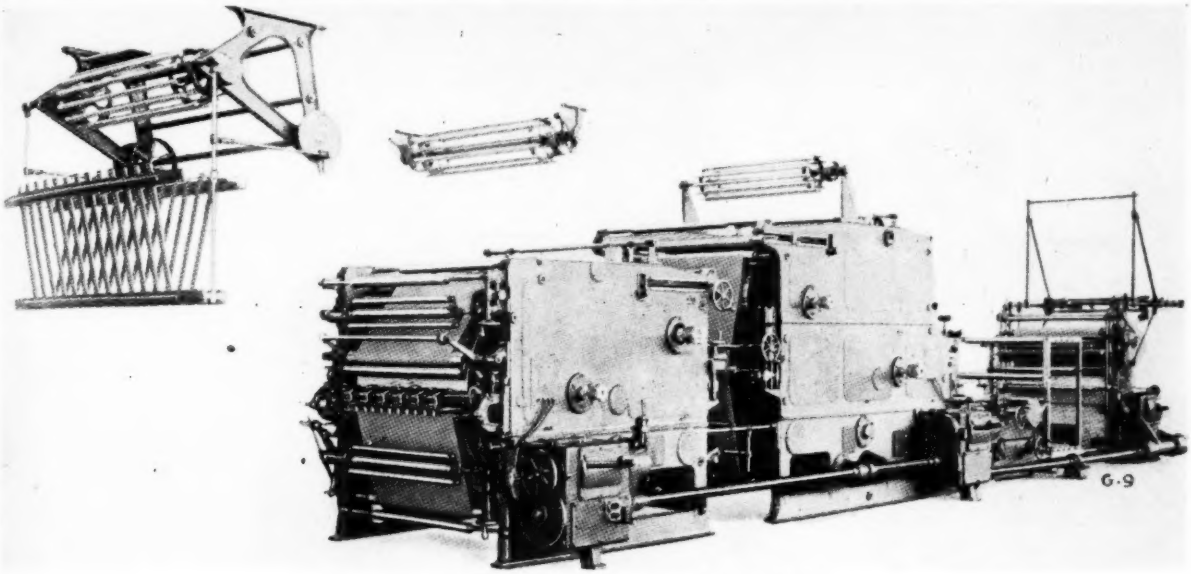
EARLY ATTEMPTS TO "PRESHRINK" COTTONS——Two expedients were tried to overcome this difficulty. First, all collar fabrics were "preshrunk" by soaking the piece goods in water and then slack-drying them. Second, the collars were cut with an extra allowance to provide for the anticipated shrinkage. However, both methods were ineffectual. Let us examine this problem more closely.

The collars were made of three different types of fabric, for example, a front ply of 96 x 100, a heavy interlining of 2.75 fabric to help provide stiffness and a back ply of 80 x 80 or similar fabric. Each of these materials had different shrinkage characteristics, and there was no way to finish them so as to guarantee that every ply would have the same residual shrinkage as the other two plies. Consequently, not only did the collars themselves vary widely in size, but many of the finished collars had to be thrown out as seconds because of wrinkles due to uneven shrinkage of the various plies.

An attempt was made by one well-known manufacturer to obtain more uniform preshrinkage by means of a hydraulic press. This device was used to press the water through and out of the piece goods as the webs laid in yard folds in heavy metal-lined vats. This step was followed by the usual slack drying. Sometimes a slight improvement in shrinkage was observed over the older method but not enough to solve the shrinkage problem.

One suggestion was that an extra amount of twist should be incorporated within the yarns themselves with the hope that this twist would open up enough during the bleaching and finishing operations to compensate for the shrinkage. However, the warp tensions used in commercial bleaching and finishing were far too much even for this special fabric.

* Presented before the Hudson-Mohawk Section in Albany, N Y on Dec 4, 1953. Manuscripts received by the Editor of Proceedings on March 15, 1954 and submitted to *Am Dyestuff Reptr* May 11-June 1, 1954.



Compressive shrinking range—Morrison Machine Co.

SANFORD CLUETT'S WORK ON CONTROLLED SHRINKAGE

FIRST PRACTICAL METHOD——— Starting in 1927, Sanford Cluett, then director of research for Cluett, Peabody & Co, Inc, made a personal investigation of this problem. As a result of his unique experiments, he obtained a patent on the first practical method of shrinkage control for cotton fabrics. Mr Cluett's original idea was to shrink the fabric in the warp direction by means of an overfeeding device attached to a pin tenter frame. The process then consisted of overfeeding the fabric by a predetermined amount, pulling it out in the filling direction, spraying the fabric with water, and drying it on the frame in an enclosed heated housing. This process was a great improvement over the old cold-water shrinking method. For the first time a machine was available that could shrink fabric a predetermined amount. However, there were several disadvantages to this original shrinking process. First, the fabric occasionally came off the pins thus causing delays in production; second, the pin holes themselves sometimes were objectionable; third, there was no positive method of insuring that the width or filling shrinkage would be within the 1% tolerance which was desired; and, fourth, the finish and hand of the finished cloth was not as attractive as was previously obtained by high-pressure calendering.

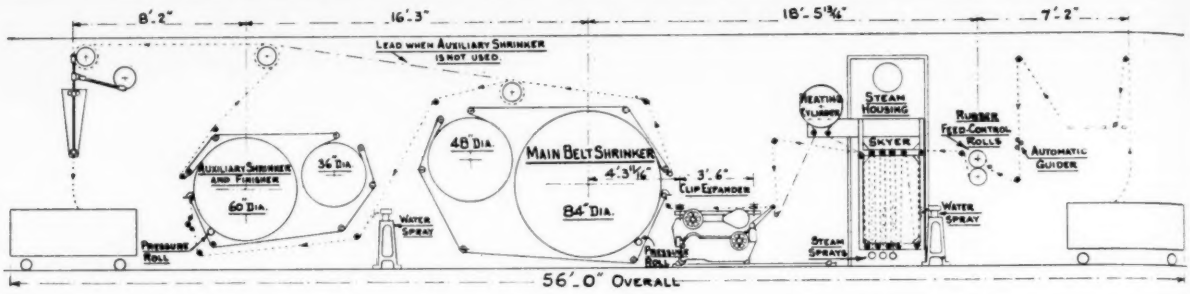
THE COMPRESSIVE-SHRINKING PROCESS———Recognizing these faults, Mr Cluett designed an entirely new and novel machine, for compressively shrinking fabric, that would overcome all of these difficulties. Here are the outstanding advantages of the machine, which turned out billions of yards of fabric with less than 1% residual shrinkage, carrying the world-famous "Sanforized" trade-mark:

1) Shrinkage control positively insured to 1% residual shrinkage in both warp and filling.
2) High-speed consistent operation.
3) Improved finish and hand of the fabric.
4) Elimination of pin holes in the selvedges.

The principle of the compressive-shrinking process can best be described in conjunction with the illustrations on pages P465-6. An endless felt belt is passed over a feed-in roll. This stretches the outside of the belt and contracts the inside. The blanket continues around a large steam-heated drum, against which it is firmly pressed. Notice that the outer side of the blanket which had been stretched around the feed-in roll is now compressed since its curvature has changed from convex to concave. Electrically heated shoes are mounted above the blanket on the feed-in roll and hold the fabric that is to be shrunk in close contact with the stretched section of the blanket.

The fabric, which has previously been dampened with water, is drawn onto that portion of the blanket which is stretched by the sharp curvature of the feed-in roll. The fabric is held in very close contact with this surface first by the heated shoes and then by the drum. The reversal of curvature of the blanket as it starts around the drum forces the fabric in contact with it to shorten a certain amount. The amount of shortening depends upon the thickness of the blanket. For example, a blanket which is one-half inch thick has the capacity of shortening the fabric in length 6 inches per yard, or 16.6%. A blanket which is ¼" thick has the capacity of shortening the fabric 2.85 inches per yard, or 7.9%. Generally, a blanket having a higher shrinkage capacity than required for a certain fabric is used. The proper setting of the rubber control rolls then results in a certain lengthwise tension on the fabric between these rolls and the feed-in roll. The fabric at our bleachery usually comes to the compressive shrinking machine somewhat narrower than required and is brought to the correct width by the clip expander. The amount of shrinkage can be closely regulated by means of change-gear boxes on the main machine and on the rubber control rolls. These controls can be set to obtain any required shrinkage up to the shrinkage capacity of the felt belt with which the machine is equipped.

When the change gears on the main machine and on the rubber control rolls are set at zero, the surface speeds of both the large drum and the rubber control rolls are exactly the same. Therefore, with this setting there will be no net change in the length of the fabric. However, if we set the change-gear box on the main machine at ¾" shrinkage and that of the rubber control rolls at 2" shrinkage, then the surface speed of the large drum will be 2¾" per yard slower than that of the rubber control rolls thus



Layout for the compressive shrinking range shown on page P465

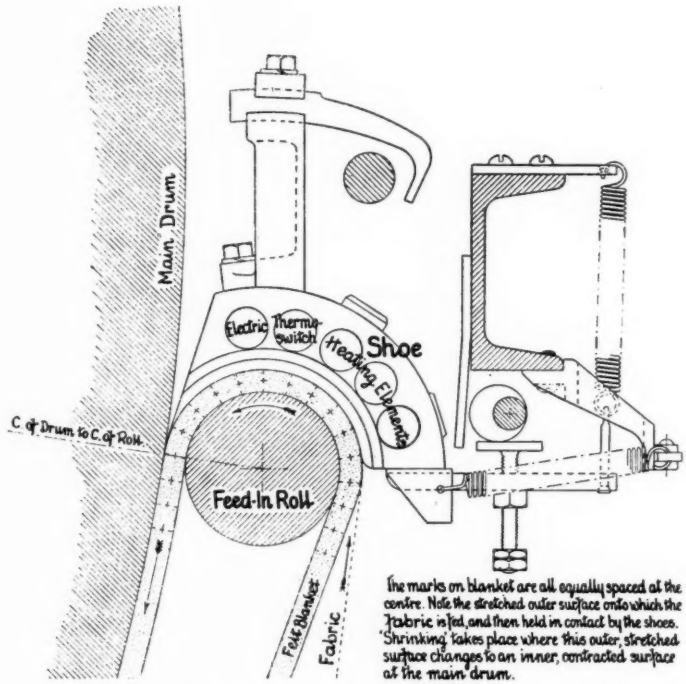
shrinking the fabric 2¾" per yard in length.

A complete modern compressive-shrinking range operates as follows: A standard wash test as described in Federal Specification CCC-T-191a is made on a sample of the fabric to be shrunk. The change-gear settings on the main machine and on the rubber control rolls are set to obtain the desired shrinkage as indicated by the test. Also, the clip expander is set to obtain the correct over-all width for the finished goods.

The fabric passes over a rather high skying bar, then through automatic guiders and through the nip of the rubber control rolls. It then goes through an enclosed skyer, where it is sprayed with water. Next, it travels over a revolving heated cylinder. Here the water is driven into the fibers and more uniformly distributed over the surface. The fabric is also preheated at this point, thus helping to keep the shoes from cooling, making the fabric more plastic and increasing the rate of production.

Next, the fabric passes through the clip expander to obtain the correct width and through the main machine as previously described. Some ranges have an auxiliary machine following the main machine. This equipment is set up backwards in relation to the main machine. This permits the side of the fabric which had been against the felt belt to pass over the drum surface and thus to obtain a smooth finish on both sides.

Shortly after the start of a particular lot through the range, yard marks are placed at several places along the selvedge of the unshrunk goods. These marks are checked by the operator as the fabric emerges from the end of the range to see if it has taken up the required amount. In addition, wash tests are made on the compressively shrunk goods to be certain that the residual shrinkage is less than 1% so that the lot can carry the "Sanforized" label.


Main Drum
Electric
Thermo-switch
Heating Elements
Shoe
C. of Drum to C. of Roll
Feed-In Roll
Felt Blanket
Fabric
The marks on blanket are all equally spaced at the centre. Note the stretched outer surface onto which the fabric is fed, and then held in contact by the shoes. 'Shrinking' takes place where this outer, stretched surface changes to an inner, contracted surface at the main drum.

Detailed operation of the compressive shrinking machine

THE RUBBER-BELT MACHINE——— The latest development in the compressive-shrinking process is a rubber-belt machine, for which a patent has been applied. This is a unique device in a number of interesting ways. This is the first rubber-belt machine which can shrink fabric a definite predetermined amount up to 2½ inches per yard at speeds as high as 100 yards per minute. Second, a micrometer adjustment provides for changes in the nip as fine at 0.025 inch per yard. This is much closer than required but helps make it easy for the operator to hold the finished fabric within the 1% shrinkage or gain tolerance.

No heated shoes are required. The belt carrying the dampened fabric is squeezed as it passes between a pressure roll and the large metal drum. This pressure results in perfect contact between the belt and the back of the fabric and between the face of the fabric and the smooth surface of the drum. An exceptionally smooth finish is thus produced on both sides of the fabric at the same time.

The rubber belt now in use at the Waterford Bleachery has processed 9,500,000 yards of fabric. However, a grinding operation must be performed about every half-million yards to keep the entire surface of the belt absolutely smooth.

CONCLUSION

The compressive shrinking process has been remarkably successful for two reasons: first, it eliminated shrinkage troubles connected with finished cotton goods; second, it has been the subject of an outstanding promotional campaign, which has educated consumers to ask for cotton garments carrying the trademark "Sanforized."

II. STABILITY CONTROL OF COTTON KNIT GOODS

IRWIN J SMITH
Surpass Chemical Co, Albany, N Y

Knitting, especially circular knitting, and the subsequent processes of bleaching, dyeing, drying and calendering all put lengthwise tension on knitted cotton fabrics. They thus become dimensionally unstable unless relaxed by some method of shrinkage control. The author explains three physical methods of accomplishing this purpose: the Redman Process, the Tube-Tex Tensionless Calender, and tumble drying. The more recent use of especially urea-formaldehyde resins in stabilizing knitted fabrics is also discussed.

INTRODUCTION

THE nature of knitting and circular knitting in particular and the processing which follows knitting, such as bleaching, dyeing, drying and calendering, all put lengthwise tension or elongation on the knitted fabric. The effect is an elongated, or tear-drop-shaped stitch pattern, which, if allowed to remain in this construction through the cutting and sewing operations, produces a fabric that may be described as "unstable." When this finished cloth is washed, the knitted stitches will tend to relax and move in a more circular form. After washing, the stitches seek their natural position, and, as a result, there is a shortening in length and a gain in width. If no effort has been made previously or in the final calendering of the cloth to neutralize these effects, excessive shrinkage will take place in washing.

What the minimum or maximum shrinkage specification should be in washing knit goods is still a debatable question. One group believes that shrinkage relaxation should be under 3% screen-dried. A certain few are striving for the 1% shrinkage minimum that is standard for woven goods. Another group believes that to practically and economically strive for this minimum would lessen many of the advantages and qualities of a knitted garment, which, in their opinion, should allow considerable tolerances for flexibility because of its construction.

Most of the present relaxation shrinkage-control processes aim to produce a fabric having a shrinkage tolerance of 3 to 5%, based on screen drying methods. However, the construction of the cloth must be taken into consideration, as an 8% shrinkage might be considered poor for ribbed goods, very good for balbriggan cloth and excellent for interlock cloth. Tumble drying of cloth after washing usually adds approximately 5% shrinkage over screen-drying methods.

Because of the increased use of Bendix-type washing machines and tumble drying units in the home, and inasmuch as a large majority of knit goods are washed in the home, it would be preferable and more consistent if shrinkage tests on knit goods could be made by tumble drying methods. Along these lines I quote, in part, from the *Institute News* concerning a resolution of the Underwear Institute's Shrinkage Committee, which met on October 7, 1953, as follows:

"The Committee passed a motion to adopt the ASTM test method for shrinkage, which includes alternative methods of drying, screen drying, and tumble drying. The members of the Committee brought out the fact that woven goods shrink as much as knit goods in tumble drying, and they felt that the Federal Trade Commission should preserve a competitive balance between knit goods and woven goods by making the test for woven goods the same as knit goods, that is, tumble drying. The motion was passed and accepted that knit-good manufacturers drop the screen-drying test at the time woven-goods manufacturers take the same step."

MECHANICAL METHODS

THE REDMAN PROCESS——Shrinkage control in circular knit goods has only come to be a factor in the past five years. It was previously developed through the efforts of the Quartermaster Corps in conjunction with the Knit Underwear Institute. A fund was raised through the Underwear Institute, and the first machine built through these co-operative efforts was called the Redman machine after its inenvtor, Frank Redman.

As originally introduced to the knit goods trade, the Redman Shrinking Process consists first of the operation described as *normalizing*. Normalizing is the method of expanding tubular knit fabrics to the proper degree of width, depending upon their construction. In normalizing, the extracted cloth is spread to an expanded state by running the wet cloth over an expanded driven spreader to a width approximately 1½ times that of the cylinder size on which the goods were knit. This spreading is an instantaneous operation wherein the fabric is opened out to this dimension while it is moving through the machine at a rate of seventy yards per minute. After the process of wet normalizing, the fabric is transferred to the feed end of the shrinker, or basket dryer, where the cloth progressively tumbles into a series of continuously fed mesh baskets, which are constructed so that the length of the loops does not exceed six inches, thus eliminating the tension which occurs in the ordinary loop dryer, due to the longer length of the loops and the heavier downward pull of the wet or damp cloth. As this series of baskets passes through the drying zone, drying and relaxed shrinking are accomplished by an upward impinged air circulation system, which literally causes the cloth to float, slightly agitated, because of the velocity of the hot air. When the material comes out of the basket dryer, the shrinkage is approximately zero. This material is then fed into calenders with specially driven spreaders, so that this low shrinkage is not lost by tension in this operation. The material can be finished in rolls or in flat folds.

The shrinkage relaxation obtained by this Redman Process is said to be excellent and claims to be lower than that obtained by other methods. However, because of the high capital investment required, Redmanizing could only be considered by a small group of the larger mills, and after the original machines were introduced it soon became apparent that, to make this method available to the smaller mills, it would be necessary to adopt an alternate method wherein conventional drying equipment already in place could be utilized. Therefore, the expensive basket-type dryer has been eliminated and conventional extracting and regular loop drying is practiced as usual, and the goods, instead of being normalized wet, are normalized in the dry condition, which presumably performs the same function. Normalizing in the dry state again overspreads the dry cloth approximately 1½ times over knitting size. The goods are finished to size as before

over the tensionless calender and then are mechanically folded. It is stated that the Redmanized fabric system is very versatile and that it offers consistently low shrinkage on a wide variety of tubular knit goods meeting rigid wash tests and having an excellent hand.

THE TUBE-TEX TENSIONLESS CALENDER——The next machine I will discuss is known as the Tube-Tex Tensionless Calender. This calender was designed as a finishing machine wherein circular knit fabric can be spread, steamed and folded in a single operation with total elimination of lengthwise drag or tension and with restoration of the knitted fabric to its relaxed or constructed position.

Conventional methods of calendering knit goods, up to the introduction of the Tube-Tex Tensionless Calender, made use of wire or nip-type spreaders. Generally, as the cloth is being rolled up under tension, the conventional equipment tends to pull the cloth out in length and down in width. The result, after washing, is a shortening in length and a gain in width. "Redmanizing" attempts to overcome this elongation in length and accompanying pull down of width by spreading the cloth excessively in width to reduce the length shrinkage, but, generally, at the expense of increased loss in width after washing.

The Tube-Tex Tensionless Calender spreads the fabric over a patented propeller-driven spreader, which is the mechanism that conveys or overfeeds the fabric into a steaming area, and the cloth then passes into this steaming zone in an overfed, or riffled, condition. It is then passed through a pair of polished finishing rolls and elevated, still in the riffled form, on a series of conveyor cross bars that are inclined at an approximate angle of 45 degrees to a height of seven feet. The cloth then drops off a doffer roller by gravity entirely tension-free onto a flat folding machine, where it is piled in bundles for the cutting room.

The Tube-Tex system of tensionless calendering provides a means of producing fabrics having balanced shrinkage. It thus gives a cloth minimum length shrinkage and a tolerable amount of width shrinkage, which are claimed to be of advantage on many types of knitted cloth. Inasmuch as the final shrinkage results obtained by use of this Tube-Tex calender are so far superior to the conventional spreaders and calenders in use and the initial costs are low, it has been readily adapted by a large group of knitting mills, and it has become the predominant machine in the field of knit goods shrinkage-relaxation methods.

TUMBLE DRYING——Another means of mechanical shrinkage control on knit goods, which is lesser known but which holds possibility for the control of shrinkage, is tumble drying. Tumble drying may be practiced on the finished garments after they have been sewn or on the cloth itself. A conventional tumble-type dryer, such as is used in laundries, is required.

In tumble drying garments, the garments, after having been cut and sewn, are entered dry into the tumble dryer, and jets of steam are introduced into the shell of the dryer while the garments are being tumbled for a period of from five to seven minutes. The garments are then removed, straightened out and pressed.

The shrinkage relaxation obtained from tumble drying has been excellent and well within tolerances established by other mechanical methods. However, garments upon removal from a tumble dryer are quite distorted, and goods do not have the finished appearance of those that have been run over the previously described calender and finishing machines. To eliminate some of the shortcomings of the tumble drying of garments, knit goods are being tumble dried in the roll or piece. In this case, wet goods, which have first been centrifugally extracted, are placed in the tumble dryer, and hot dry air is blown through the cloth until the cloth is dry. This takes about 15 minutes. The cloth is then removed and finished by carefully framing or by running over a calender or steaming machine. As the shrinkage results have been excellent, this method has been practiced in finishing large quantities of a construction known as waffle stitch, which goes into knitted underwear made for the United States Navy. It should be noted that the waffle stitch is a Raschel-knitted cloth and not a circular knit.

RESIN TREATMENT

Up to now, I have discussed only the control of shrinkage on knit goods by mechanical means, but, in the past two years, a great deal of research and investigation has shown the possibility of controlling shrinkage by the application of resins to cotton circular knit goods. Excellent shrinkage control is now being obtained from the use of various resins. Resin treatments, by themselves, usually greatly improve the shrinkage results that would be obtained by the use of conventional knit-goods finishing equipment. It is also best to use resin treatments in conjunction with any of the overfeed-type finishing equipment.

As a large percentage of knit goods, particularly underwear and T-shirts, is sold in the bleached or white state, it is most important that the resin used have little or no tendency toward chlorine retention, and it must be nonyellowing to stand the heat required during the drying and heat-curing treatment required for fixation. Resins that are being used on knit goods are mostly of the urea-formaldehyde type that meet these specifications, but there has been some experimentation with melamine-type resins.

The resin is generally prepared in the proper concentration, along with the proper catalyst, and padded on the dry knit cloth from a padding machine or through a Tube-Tex Processor. It is then dried and cured in a loop dryer or run through a drum-type dryer at temperatures of 260 to 310° F for the required curing time to set the resin. Inasmuch as many resins leave an odor or residue in the goods and because of the fact that a large majority of knit goods are worn next to the skin with the possibility of dermatitis, the goods are scoured to remove any odor and residues and are finally redried and finished.

Drawbacks to the first applications of resins to knit goods have been that resin treatments have tendered the goods, have yellowed the bleach and have killed elasticity and softness. Also, from two to three dryings are required, compared with one by mechanical shrinkage methods. Other drawbacks were the added costs of application, including the costs of the resin, which were not justified by the results obtained. However, many of these drawbacks are now being overcome by the introduction of new and improved resins and by improved application techniques. More and more resin treatments will be adopted during the coming year, as many mills, which first passed them by, now feel that the improved shrinkage results being obtained with resin treatments warrant further investigation and use.

CONCLUSION

Perhaps the final answer to minimum shrinkage control on knit goods will be a combination of mechanical shrinkage control in conjunction with a resin treatment.

In closing, let me state that a most important factor in shrinkage control is to have a properly constructed piece of cloth at the knitting machine. The proper number of needles for the gauge or cut of the machine is most necessary, and the proper-size yarn to fill these needles is required. Only if these fundamental construction factors are followed will shrinkage in washing be held to a minimum no matter what after-shrinkage control process or method is used.

III. WOOL-SHRINKAGE-CONTROL TECHNIQUES

FRANCIS A MURPHY

Sanforlan Technical Service, Cluett, Peabody & Co, Inc, Troy, N Y

Wool textiles shrink because the curling wool fibers are covered with overlapping scales that point away from the roots and permit twisted and entangled fibers to move in only one direction and thus closer to each other when subjected to heat, moisture and mechanical action. This felting action of wool and consequent shrinkage can be prevented by alteration of the scales so as to preclude unidirection friction.

After the author has explained this mechanism of wool shrinkage, he briefly outlines the various chemical methods by which wool can be made to lose its tendency to felt and shrink. The emphasis in this part of the discussion is on control to effect even treatment with minimum loss of resiliency, hand, and warmth and with maximum maintenance of permanent whiteness.

INTRODUCTION

ONE of the reasons for the early acceptance of wool for clothing material is its ability to full or felt. Now, although this tendency to felt is desirable and essential in the manufacture of some types of woolens, it also creates the hazard of shortening the useful life of items made from it by further felting if the garment is subjected to washing. The inability of a woolen to retain its original size has been recognized for years as one of its principal limitations, and a great deal of work has been done to eliminate this undesirable feature.

Until just prior to World War II, very little wool treated for shrink resistance was actually put on the market in the United States. However, during the war the Quartermaster Corps found the average wear life of treated socks was more than doubled by treatment for shrink resistance and therefore looked into the possibility of treating other types of woolen items. As a result, since the outbreak of the Korean hostilities, the Army has greatly expanded its procurement of shrink-resistant items. In addition to wool hose, many millions of yards of underwear, jack shirting, and blanket fabrics have been produced. This trend has greatly stimulated the interest of civilian producers of woolen fabrics, and every indication points to the increased use of woolens that have been treated for control of felting shrinkage and, in addition, manufactured and made-up so that mechanical tensions are minimized.

MECHANISM OF FELTING——— The causes and the mechanisms of felting, in general, have been ably explained by Speakman, Harris and others, who have shown that wool possesses two distinguishing properties that contribute to the felting phenomenon: firstly, the tendency of the fibers to bend or curl or become entangled under the influence of moisture, heat and mechanical working and, secondly, the tendency of the fibers to migrate under these same conditions. Mechanical working alone is apparently the most important single factor contributing to felting, since it facilitates fiber migration.

If we examine the surface of a wool fiber, we find it consists of overlapping scales like the shingles on a roof, such that when the fiber is rubbed from tip to root it is about twice as rough as when rubbed from the root towards the tip. Therefore, when a fabric is submitted to mechanical action, such as in laundering, the fibers tend to migrate in the direction of least resistance, namely, in the direction of their roots. However, since portions of the fibers are tied down more or less securely in the yarn or fabric, the tendency to migrate causes the fibers to wrap around each other and to form an irreversible entangled mass of fibers known as a felt.

It is apparent that the problem to be faced in the chemical treatment of wool is to alter the surface frictional properties of the fiber without at the same time impairing the other desirable properties, such as strength, elasticity, hand, etc.

This alteration of the surface frictional properties can be accomplished by one of the following methods:

1) wholesale removal of scales.

2) partial degradation of the surface of the fiber or weakening of the base of the scale so that the scale loses its rigidity.

3) masking of the scales and/or spot-welding of the fibers to one another with polymeric resins.

SHRINKAGE-CONTROL PROCESSES

The shrinkage control processes that have been used commercially fall into four main classes: 1) enzyme, 2) solvent, 3) resin, and 4) oxidation.

Papain and Tripsin are two enzyme methods which have been used. Papain in the presence of a dilute solution of sodium bisulfite has an intense action on wool, and, although the process is still used to some extent in England, it has not been used to any extent in this country, since the loss in weight of wool substance in comparison with the degree of shrinkage control accomplished is excessive.

The alcoholic-alkali process, developed from the research of Freney and Lipson, involves the treatment of wool with alkali under such conditions that only the surface structure of the wool fibers is attacked and altered to eliminate felting. The degree of control attained with this process is good, but, unless the procedure is carefully controlled, it tends to damage the wool and impart a harsh handle. However, the biggest objection from the mill viewpoint to the alcoholic-alkali method is the use of solvents, and, unless an expensive solvent-recovery system is installed, the cost of the treatment is much too great for commercial use.

Two of the more recent processes developed in the United States for controlling shrinkage are based on the impregnation of the wool fabric with resins. One type involves the use of thermoplastic rubber-like compounds, which require no cure and which are applied to a padder in the form of aqueous dispersions. Although the degree of control produced with these products is generally excellent, they have found only limited use because of the objectionable hand produced and the aging properties of the resin.

Several types of resin treatments, based on the use of thermosetting melamine resins, are in current use. The original efforts in this field were obtained by padding the fabric with a solution of resin monomer and a latent catalyst, followed by drying, curing and then washing to remove unpolymerized resin. More recent developments are centered around the use of the acid colloids of melamine resins, which, although originally prepared for use in making high-wet-strength papers, are now finding some use in the treatment of textiles. As the resin is mostly deposited on the surface of the fibers, shrinkage control is essentially attained by spot welding. These

products are being used to some degree on fabric, but again, the main objection has been the resultant hand when the desired degree of control has been achieved.

There are a number of oxidation processes available, but possibly we should consider only those that have been used on large production lots. Most of these processes involve the use of chlorine and have been referred to as chlorination treatments.

The essential weakness of most wet acid-chlorination processes arising from the speed with which chlorine reacts with wool at a low pH is that chlorine is unevenly distributed over the top, yarn or fabric with the more exposed areas absorbing a higher proportion of the chlorine. Most of the processes, therefore, are aimed at a more stringent control of the treatment, and it is in this respect, the method in which they achieve control, that most of the processes differ.

Some of the techniques used to achieve control are the following:

1) gradual addition of a hypochlorite solution to an acid bath.

2) adjustment and control of the concentration and pH values of the oxidizing liquors.

3) pretreatment or simultaneous treatment of wool with potassium permanganate on the alkaline side.

The Kroy and Kelpie continuous wet acidic chlorination processes are carefully controlled by the slow addition of a hypochlorite solution to an acid bath. The Harriset process is also of the continuous chlorination type, in which control is achieved by constantly adjusting the concentration of the bath and by maintaining the pH and temperature within narrow limits. All three processes have been used extensively on woolen items for the Quartermaster Corps.

By far the largest production of treated wool for civilian use is being handled by the SW process, which Cluett, Peabody is promoting in connection with its trademark "Sanforlan." This process, as many of you probably know, is a batch process employing permanganate and hypochlorite and can be handled in the stainless-steel equipment of the average dyehouse. The Process has little effect on fast dyes or on the desirable properties of the fiber, such as hand, elasticity, warmth, etc. During the early stages of SW development, the greater part of the wool processed for shrink resistance went into knitted textiles. Today, however, the picture has changed with the poundage handled as woven fabric being comparable to that treated as top or yarn for sweaters and other knitted items.

In addition to the SW process, we have recently licensed a new continuous chemical treatment in this country. The process was invented and developed by Stevenson Dyers in England and is of the oxidation type but does not employ chlorine. It is being used at the present time only on top, and we expect to promote the use of it on fabric in the near future. Some of the outstanding features of the process for top are that it whitens wool rather than causing any yellowing, the spinning characteristics of treated wool are comparable to those of untreated, and yarns made from it can be spun to size with normal twist.

CONCLUSION

This sums up in a brief way the various types of processes available for producing shrink-resistant wools, but, in closing, I would like to leave you with the outlook as we see it for washable wools. We at Cluett, Peabody are convinced that shrinkage-controlled woolens are here to stay and, in spite of the wide publicity given the synthetic fibers, that wool with its hand, resiliency, and warmth, plus the added feature of shrinkage control, will be the true miracle fiber of the future.

IV. HEAT SETTING SYNTHETICS

RICHARD EVANS II

Lee Dyeing Co, Inc, Johnstown, N Y

INTRODUCTION

Dimensional stability in washing has become of great importance in the tricot industry. This can be effectively attained in the case of thermoplastic fibers by heat setting the tricot fabrics. The safe operating temperatures for heat setting nylon, Orlon, Dacron, and Vinyon are pointed out by the author, and the use of steam, gas-fired hot air and electric heat in attaining those temperatures are discussed.

FOR the purpose of this paper we will confine ourselves to the heat setting of synthetics in the knit-goods field entirely and particularly in the tricot industry. While the basic principles that we will discuss will undoubtedly apply to any other industry, tricot is a material which is sufficiently difficult to stabilize that it should be very interesting from that point of view. In order to point up the rather remarkable development that has taken place in heat setting synthetics in the tricot field and the results thus obtained in the dimensional stability of these fabrics, it is necessary to consider the basic characteristics of tricot when it is made of yarn which is not thermoplastic or is not subject to heat setting.

I would not endeavor to enter into a discussion of the stability of these fabrics from the testing point of view. It seems that every effort to standardize wash-shrinkage testing, for instance, is met with very complicated difficulties, so that in general we have found no correlation existing between any two sets of wash-shrinkage test results. Therefore, suffice to say that any statements I can or may make in connection with the stability of synthetic fibers after heat setting would have to be considered from the comparative point of view, that is, considered in regard to its variation from a test of some standard material, such as 5.35-yard-per-pound 55-denier acetate at 108".

The appearance of the heat-set yarns used in the tricot field and the development in heat-setting equipment in the last few years have brought about a revolutionary situation in the tricot field. The tricot cloth thus commercially handled is now gaining wider acceptance and is finding more standard end uses than was possible in the past. The result of this development was, of course, the present dimensional stability of these fabrics, which naturally has produced a very large customer acceptance in the various washable-garment fields.

Historically, tricot cloth had quite wide acceptance, since it basically is a cloth which has very fine texture, a pleasant hand and very nice elasticity whether made of silk, rayon, or acetate. As a consequence of these properties, tricot has found great acceptance in the lingerie field. However, there was one basic drawback to the material, namely, it was not very dimensionally stable to washing. During the Second World War when fabrics of certain types were in extremely short supply, tricot cloth was in very

great demand in a special field, that of print cloth for dress goods. As is the natural tendency when selling is easy, the yardage requirements presented to the finisher for printing was usually stretched far beyond safe limits as far as shrinkage control was concerned. Not only did the cloth lose seriously in length and width on printing, but, further than that, the end product of printed goods in the dress or in the bathing suit was also highly susceptible to wet shrinkage in the garment. Since a great amount of the production was 75-denier acetate in which the stitch-yarn comparison lent a certain stability and in which printing and aging or further wet processing to some extent assisted in eliminating shrinkage, the final garments didn't receive a complete black eye. There was still enough difficulty with those fabrics, however, particularly where highly stretched fabrics were put in large garments, such as housecoats or night clothes, that the industry was quite seriously affected with regard to customer acceptance.

THERMOPLASTIC YARNS AND DIMENSIONAL STABILITY

The advent of thermosetting materials in the tricot business opened a new field for the finisher and has brought new possibilities to the whole tricot industry with respect to the dimensional stability of its products. To understand the excellent qualities and characteristics of a thermoplastic or otherwise stabilized piece of material, it is necessary to consider the situation of the finisher in the recent past. In general the finisher was limited and still is limited by the final requirements, economic and technical, placed upon him by his customers or by the end product into which his merchandise will move. A shipment of cloth from a finisher must be at a certain width and must have a certain length, that is, it must yield a certain yardage per pound. In many cases for many kinds of cloth these two requirements would set up a situation for the finisher in which he would have difficulty in maintaining width or difficulty in actually having the length of his goods stay at the taped point. This is still the case for some woven fabrics where a roll of cloth in which a tape is inserted will have the tape yardage adjusted by a certain definite percent representing the amount the goods will snap back on spreading for cutting. There are many cases among many synthetics that are not in practice heat set where a problem may develop because the goods are placed at a wider width than empirically such a knitted cloth is generally extended.

The appearance of thermoplastic yarns which were satisfactory for heat setting thus gave the tricot industry huge possibilities and new horizons. In the last few years, I repeat, the development of heat-setting equipment and the heat-setting art has brought about a finished product of such dimensional stability that customer acceptance is assured.

For the purpose of this discussion we will deal with the fibers in the generic groups of the polyamides, acrylic, polyester, and vinyl derivatives. The ones we will deal with specifically are nylon, Orlon, Dacron, and the old Vinyon.

SAFE SETTING TEMPERATURES ——— From the point of view of the finisher the required knowledge about these fibers for heat setting is generally the maximum working temperatures beyond which degradation occurs; let me point out that the figures involved are those of dry heat at maximum heat-level point on dry cloth. If the melting point of nylon is 482° F, the safe operating temperature for nylon then would be in the neighborhood of 420° F. The same thing holds true with Dacron, although in general the problem is not quite the same since a much lower heat will stabilize the cloth to a wash-shrinkage test, and this fiber has a tendency to yellow and stiffen in our experience at 420° F. Orlon also has a melting point close to these last two, but, in general, high heats are not used on this fiber because the process desired is different from the setting process necessary on the other two. This fiber will relax at temperatures of about 250° F and up, so that in some industrial fabrics the object is to expose the goods to heat in order to shrink them as the fiber relaxes. In the case of Orlon tricot the use of about 350° F would relax the internal tensions of the fibers enough while the goods are held in a stable position to give a fabric which is stable to a wash-shrinkage test. Another acrylic fiber, Dynel, has a much lower melting point, and so processing of the fabric must be controlled well below 250° F. Among the vinyl derivatives Vinyon also has a very low melting point and will actually disappear around 250° F. The safe operating temperature for Vinyon is then well under 212° F.

The basic concept of heat setting thermoplastic fiber is a time-temperature relationship. There must be constant control of heat levels, not only to achieve a commercial result in connection with maintenance of color edge to edge, length to length, and piece to piece, but also because any introduction of variation of heat level must vary the quality of the work.

THREE HEAT-SETTING METHODS ——— The three basic methods of heat setting in use at the present time are autoclave steam setting, gas-fired hot-air setting, and electric setting. In each of these cases stabilized end products are achieved, which are highly satisfactory to the wash test. Here again we would like to point out that these are the methods that are in use at the present time on nylon tricot. There is another type of heat treating generally done on woven goods which is contact setting or contact-and-hot-air-combination setting. At the present time there are two methods generally in use in the tricot field, the hot-air method and the electric method. We will pass over the autoclave method since this last does not generally lend itself to continuous production or refinement in control results.

CONTROL OF HEAT SETTING ——— There is a definite limit in regard to time of exposure and elevation of heat in the heat setting of fabrics. This limit is the oxidizing or yellowing of the fabric. It is generally agreed that the use of a high temperature for a short exposure of time will produce less oxidizing or less yellowing than the use of a lower temperature for a longer exposure time. For this reason, because of our experience in this direction, we feel that electric setting lends itself to a greater range of possibilities over a larger number of kinds of fabric. However, good commercial results in stabilizing are achieved by the gas-setting method and by the electric-setting method with either one or two passes. In either case I would like to point out that the working heat level, the safe heat level, we have referred to, is the highest temperature that the cloth reaches, and, to all intents and purposes, it must only be at that temperature for an instant. This means that, in any of the accepted conventional heat-setting methods as the cloth passes through the heating chamber, the cloth rises from its entering temperature to such an end point as empirically is found to be a safe maximum temperature for the fabric. In this way it is obvious that the time aspect of the time-temperature relationship is greatly minimized.

STABILIZATION RESULTS

Now I will summarize the dimensional stability of these various abovementioned fabrics to wash shrinkage tests. The regular wash-shrinkage test, which is quite general for the severe testing of dimensional stability in textile fabrics of this type, is carried out for a half hour at the boil. We find that a shrinkage on a nonrestored basis of these elastic cloths of 2 to 6% total length and width would represent a satisfactory commercial stabilization.

This test is designed to compare with at least 15 hand washings. This we compare by the same test on nonheat-set fibers to a test of around 20%, in other words, in general you would expect to get on a heat-set fabric a result which is 1/5 to 1/10 the total shrinkage of a nonheat-set fabric.

The advent of set nylon actually brought about a situation in the tricot business whereby, for the first time, properly processed material was actually yard-to-yard similar in quality and yard-to-yard stable to washing.

We feel in general that technical co-operation between the yarn producer, knitter, and dyer can improve the finished product now or at anytime and at any level of quality.

V. DIMENSIONAL STABILITY OF VISCOSE RAYON

HERBERT J LEAVITT

Cluett, Peabody & Co, Inc, Troy, N Y

The author points out that cotton fabrics undergo moderate relaxation shrinkage upon a first wash and then no subsequent shrinkage upon further washing. Rayon fabrics undergo high relaxation shrinkage upon the first wash and then continue to shrink moderately with every wash thereafter. Compressive shrinkage, which takes care of relaxation shrinkage, is therefore adequate to take care of all of the shrinkage problem for cottons but not for rayons.

By the treatment of rayons with aldehydes in the presence of an acid catalyst, however, cross-linkages can be formed between the cellulose chains of rayon to prevent the progressive shrinkage that takes place in the continuing washing of rayons. The four important methods for treating rayons commercially to accomplish this are discussed.

INTRODUCTION

SHRINKAGE is one of the most important characteristics of a fabric from the viewpoint of the consumer, and, in the case of rayon, its control has been one of the most elusive until recently. Much research and development has been carried on in this field, and today, at long last, washable rayons are being presented to the consumer.

You might ask, particularly in view of what you have just heard about cotton shrinkage and its control, why has it been so difficult to control rayon shrinkage? Could not rayon also be compressively shrunk? I shall try, in the brief time allotted to me, to explain why this was impossible, and what has actually been done to control rayon shrinkage adequately.

In order to do so, it is necessary first to define *shrinkage,* not in terms of *Webster,* but rather in terms of the two kinds that must be distinguished. The shrinkage of the first type is *relaxation shrinkage;* that of the second type, *progressive shrinkage. Relaxation shrinkage* may be defined as that shrinkage occurring during the first wash; *progressive shrinkage* may be defined as that shrinkage occurring during subsequent washes.

These kinds of shrinkage are exemplified by the three fibers being discussed this evening as follows:

Cotton exhibits moderate relaxation shrinkage and no progressive shrinkage.

Rayon exhibits high relaxation shrinkage and moderate progressive shrinkage.

Wool exhibits moderate relaxation shrinkage and high progressive shrinkage.

Since compressive shrinkage, as pointed out by my colleague, is a mechanical, physical compression of the yarns, it can only compensate for relaxation shrinkage, the shrinkage occurring during the first wash. Cotton, exhibiting only this relaxation shrinkage, can therefore be stabilized by the compressive-shrinkage technique. Rayon, however, exhibiting both relaxation and progressive shrinkage, would, even after the application of this compressive technique, still exhibit progressive shrinkage, only relaxation shrinkage having been eliminated. Furthermore, rayon, exhibiting much higher relaxation shrinkage than cotton, would, after compressive shrinkage, become too stretchy a fabric for any practical purpose.

CAUSES OF RAYON SHRINKAGE

I should like now to go into some of the causes of shrinkage, illustrating thereby some of the reasons for which rayon exhibits so much more shrinkage than does cotton.

The first and probably the most important cause of shrinkage in fabric is the tension exerted on yarns, fibers and fabrics during the spinning, weaving and finishing operations. Figure 1 shows, in flowsheet form, most of the procedures a fabric is subject to before it is cut and made into a garment.

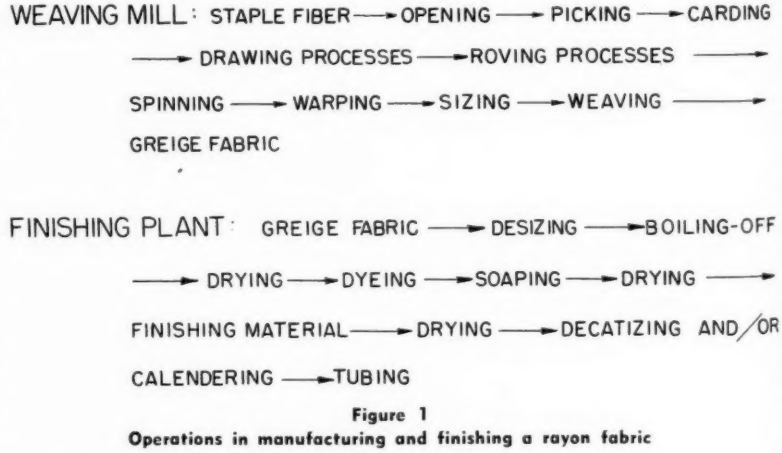

WEAVING MILL: STAPLE FIBER → OPENING → PICKING → CARDING
→ DRAWING PROCESSES → ROVING PROCESSES →
SPINNING → WARPING → SIZING → WEAVING →
GREIGE FABRIC
FINISHING PLANT: GREIGE FABRIC → DESIZING → BOILING-OFF
→ DRYING → DYEING → SOAPING → DRYING →
FINISHING MATERIAL → DRYING → DECATIZING AND/OR
CALENDERING → TUBING

Figure 1

Operations in manufacturing and finishing a rayon fabric

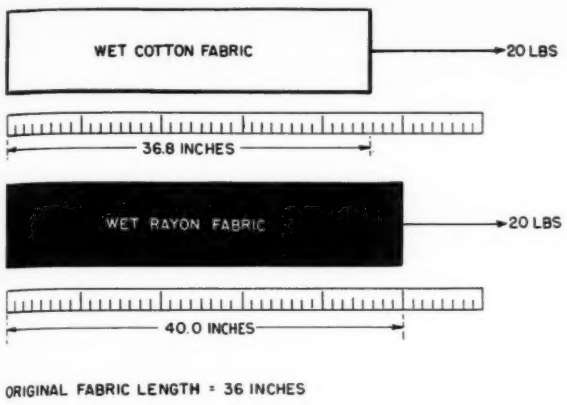


Figure 2
Wet stretch of cotton and rayon fabrics

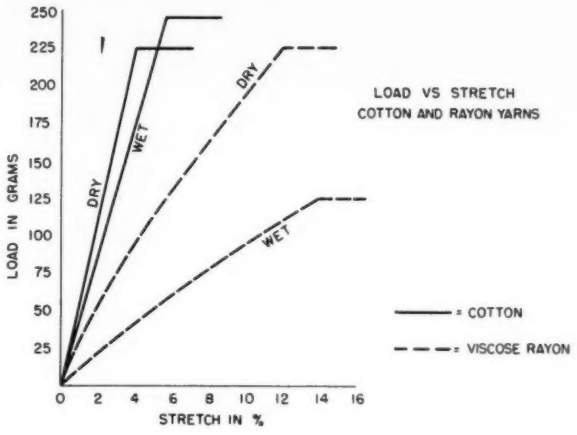


Figure 3

Thus, in the weaving mill you find staple fiber going through opening, picking, carding, drawing and roving processes; followed by spinning, warping, sizing and weaving into the greige fabric. In the finishing plant the greige fabric must be desized, boiled off, dried, dyed, soaped and dried again before finishing material is applied and the fabric is once again dried, calendered and/or decated, inspected and tubed. Little wonder, then, that a fabric shows shrinkage after so much handling.

The second factor in shrinkage is wet elongation of the fiber. This property is intimately tied up with the first factor of tension as a cause of shrinkage.

Figure 2 illustrates the difference in stretch caused by equal tension on a yard of wet cotton fabric and a yard of wet rayon fabric because of the difference in wet-elongation properties. The cotton has stretched only 0.8 inches, or 2.22%, while the rayon has stretched 4.0 inches or 11.11% under the same load. This difference illustrates that, although tensions are present in the processing of both these fabrics, rayon exhibits much higher relaxation shrinkage than does cotton.

Figure 3, wherein we see a graph with stretch in "%" plotted against load "in grams," again illustrates this difference in wet-elongation properties between cotton and rayon. This graph, wherein yarns were used to obtain the data, shows a load of 100 g producing approximately a 2¼% stretch of wet cotton yarn as compared with an 11% stretch of wet rayon yarn, checking quite well with the findings on the fabric illustrated in the previous figure.

The third factor in shrinkage that I should like to bring to your attention is the swelling characteristics of the fiber. Figure 4 shows the percentage increase in diameter and cross-sectional area when cotton and rayon are wet. Cotton shows only 12% increase in diameter and 26% increase in cross-sectional area, while rayon shows 42% increase in diameter and 100% increase in cross-sectional area. Since swellability is directly proprotional to shrinkage, we see illustrated here another reason for rayon's greater shrinkage than cotton.

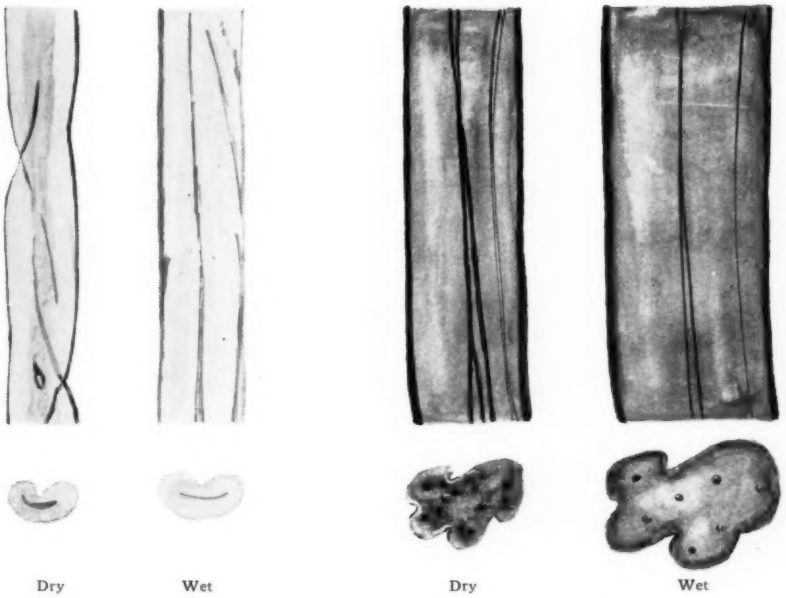


Figure 4
Swelling of cotton and rayon fibers

Thus, the combination of high wet elongation plus high swellability permits rayon to be stretched excessively during processing and gives it high shrinkage. In fact, there is so much shrinkage to the normal viscose-rayon fabric because of these factors that one wash is insufficient to relax the fabric completely; subsequent washes relaxing the fabric more and more to produce the phenomenon we call progressive shrinkage.

Cotton, having low wet-elongation properties and low swellability, cannot be stretched excessively during processing and consequently exhibits low shrinkage. Since this shrinkage is so low that all of it is removed in one wash, there is no phenomenon of progressive shrinkage.

Cotton can therefore be stabilized by compressively shrinking the fabric sufficiently to remove all latent shrinkage in the fabric as evidenced by one wash.

Rayon, however, cannot be so stabilized, since, as stated previously, it would continue to shrink in subsequent washes. Because mechanical means are inadequate, chemical processes must be resorted to in the case of viscose rayons to effect dimensional stabilization.

CHEMICAL CONTROL OF PROGRESSIVE SHRINKAGE

UREA-FORMALDEHYDE METHOD ——— Until recently the most widely used chemical process for controlling the shrinkage of rayon has been the application of urea-formaldehyde resins. These resins have been applied by impregnating the fabric on a padder with a treating bath containing the urea-formaldehyde precondensate plus a catalyst, drying and curing the fabric, washing and neutralizing to remove excess chemicals, and, finally, drying the cloth and calendering or decating as required.

There has been considerable debate as to whether the stability effected by these urea-formaldehye resins is due to mechanical or chemical causes—namely, whether the shrinkage control is due to mechanical inhibition of shrinkage by deposition of resin within or about the fiber; or whether the control of shrinkage is caused by the establishment of crosslinkages between adjacent cellulose chains. The answer is probably a combination of both these factors, there being evidence to support both theories.

However, we are not greatly interested in this question because the shrinkage control effected is not permanent, and the fabric so treated cannot be considered truly washable.

What, you might ask, is a washable rayon fabric? In reply I would say that a washable fabric is one which can be washed in any manner: by hand or by home washing machine, by a commercial laundry or by beating on rocks, as is done in India. Furthermore, it should be capable of being washed at any temperature for any number of times. No "babying" of rayon. Wash rayon as you would cotton and find no more shrinkage on the twentieth wash than on the first. This is washability.

Fabrics treated with urea-formaldehyde resin cannot pass such standards. The resin washes out of the fabric, and whatever crosslinkages have been formed are hydrolyzed (broken) so that the fabric shrinks. Consequently, fabric so treated cannot be considered truly washable.

ACID-ALDEHYDE METHOD ——— There is but one type of chemical treatment of viscose rayon that can be considered as producing a washable fabric, since it does control shrinkage permanently. This is the treatment of rayon by an aldehyde in the presence of an acid catalyst. This reaction between the aldehyde and cellulose produces crosslinkages between adjacent cellulose chains similar to those formed between urea-formaldehyde and cellulose, except that these bonds are much more resistant to both acid and alkaline hydrolysis, so that laundering does not break the bond and permanent dimensional stability results.

There are at present four major processes being used commercially based on this reaction of an aldehyde with cellulose in the presence of an acid to obtain permanent shrinkage control. These are as follows:

1) Avcoset (American Viscose Corp).

2) Aquex (Aquex Development & Sales Corp).

3) X-2 (Dan River).

4) Glyoxal process (Cluett, Peabody & Co, Inc. Rayons so treated are identified by the trade-mark "Sanforset").

Time does not permit going into any great detail with any of these processes. I shall therefore briefly give you some idea as to the similarities and differences between these processes.

APPLICATION OF CHEMICAL STABILIZER TO RAYON

The procedure for application of any of these finishes is approximately the same, in fact, they are the same as for the application of urea-formaldehyde resins. The fabric is impregnated with the treating bath on a padder (2- or 3-roll), dried on a clip tenter (usually in tandem with the padder), cured in a loop dyer, airlay or roller oven, washed, neutralized, and finally slack-dried and framed on a steam clip tenter. The goods are finally calendered, if required.

The "Avcoset" and "Aquex" methods both utilize formaldehyde as the aldehyde, the "Avcoset" using cellulose ethers and the "Aquex," polyvinyl acetate copolymers as stiffening agents so as to obtain build-up and variation in hand. The "X-2" process makes use of a chemical that gives an aldehyde-type reaction with starch as a stiffener for obtaining build-up and variation in hand.

The glyoxal process licensed by Cluett, Peabody & Co, Inc, employs as its active stabilizing agent the dialdehyde, glyoxal. Urea-formaldehyde resin is included to give build-up and variation in hand. It is this utilization of urea-formaldehyde resin which comprises the major difference between Cluett, Peabody & Co's glyoxal process and the other processes, enabling, at it does, by variation of the concentrations of glyoxal and urea-formaldehyde resin, to offer any hand from a soft shirting finish to a firm "slacks" finish, all possessing that resinous, resilient feel so much in demand today in addition to permanent shrinkage control.

Truly washable rayons — previously only a fond dream of the consumer — have become a reality.

VI. DISCUSSION

PANEL

Richard Evans
Leonard S Lang
Herbert J Leavitt
Francis A Murphy
Irwin J Smith

Question: Is it true that cotton goods before compressive shrinking must not shrink more than 6 to 7% if a residual shrinkage of 1% or less is to be guaranteed?

Lang: No. We can handle a fabric with higher shrinkage if necessary. However, it is better to bring the fabric to the compressive shrinking range with as small a shrinkage as possible. The reason for this is that you don't want a stretchy fabric when you finish. For that reason, finishers who have been using these ranges for many years now are well aware of the fact that this is the best method of procedure. However, we can handle fabrics with larger shrinkages if necessary. In general, we don't.

Q: What about a fabric that has a shrinkage of 17%?

Lang: That is rather high. Generally, the fabric does not come to the range

with such a high shrinkage, and I would say that it was probably being stretched at some point along the line and that something should be done to correct that. Ordinarily, even with denims, we don't have such high shrinkage. I would say that maybe 10% would be better; the whole point being that you don't want the fabric to be stretchy after you get through with it, and, with proper controls and observation of equipment, I think you could correct that condition, so that, when you change to the compressive shrinking range, the fabric wouldn't have such a high shrinkage at the start.

Q: Does the use of UF resins in the glyoxal process cause any chlorine-retention difficulties during laundering?

Leavitt: The use of urea-formaldehyde resin in the glyoxal process will introduce chlorine retention. However, there are a number of different formulations in the glyoxal process. If you desire shrinkage control only, without the resinous build-up of hand, you can get it with the glyoxal process without any chlorine retention. If, however, you desire the type of a finish such as you would expect in a suiting or slacks where we incorporate high percentages of urea-formaldehyde resin, we thereby also introduce chlorine retention.

However, a differentiation must be made between "damaging chlorine retention" and mere "retention of chlorine." Under certain conditions, a fabric will retain chlorine but in an insufficient concentration to degrade the fabric during normal, or even during abnormal, use. Such is the situation with our glyoxal process.

Q: What do you mean by the One- or Two-Pass Method?

Evans: In the conventional processing of tricot cloth, the cloth, in general, is dried once on a tenter dryer. There are no finishing processes per se as there are usually in woven goods. In the Two-Pass Method, as the name implies, two passes are required through the tenter frame. The first pass, either before or after scouring, is for setting the goods, after which they are dyed and then passed a second time over the tenter for drying. In the One-Pass Method, such as is allowed by electric setting, the goods are scoured, dyed, and then passed only once over the tenter and through the setting unit, which is in tandem with the tenter dryer. This latter method makes for less handling of the goods.

Q: Should not the shrinking of knit goods with caustic soda be considered a method of obtaining preshrunk cloth?

Smith: I do not think you can consider that a caustic treatment gives shrinkage relaxation. Most of the caustic treatments given on cotton, and particularly on cotton knit goods, are on glove cloth. The method is similar to that of mercerization, only the goods are not under tension, such as they are in mercerization, and the caustic concentration is about half the strength it would be in mercerization.

I would definitely consider the action more of a contraction of stitch, particularly in the glove-cloth industry, where they try to get what they call a glove stretch. This means that, when they take the piece of goods and make it into a glove, it will expand or pull out with the motion of the hand. I believe it is called a 3-to-5 stretch.

Again, if this cloth should be washed without first having been given a mechanical relaxation-shrinkage treatment, I would not consider it to be shrunk in the sense of "relaxation shrinkage." Perhaps I am wrong.

Q: How does tumble drying affect compressively shrunk woven goods?

Lang: Tumble drying has been used in custom laundries for many years and is nothing new. In general, we don't have any difficulty with custom laundries tumble-drying materials that have been compressively shrunk for the reason that they generally confine that operation to towels and such articles which they want to come out fluffy. However, recently tumble dryers have gone into the home, and here there has been some difficulty when people have misused the tumble dryer by allowing their materials to tumble around excessively. Now, if the garments are taken out of the tumble dryer while they still contain a small amount of moisture, there is no excessive shrinkage. However, if they are allowed to run too long, there will be more shrinkage than there should be. In that case, it is best to rewash the garments, just to dry them so that they are still a little damp, and then to finish them. Actually, we have had very few complaints from this source. I would say that, as people become more accustomed to the use of the tumble dryer in the home, this problem should clear up and present no difficulty.

Q: How does the method patented and used by Bradford Dyeing Associates both in England and in the United States for compressive shrinkage in cotton fabrics compare with Cluett, Peabody's "Sanforized" process? Does Bradford's system use the rubber belt?

Lang: The Bradford system is called "Rigmel," and it does use a rubber belt. However, it is a very slow process and requires highly skilled operators to set that machine to get the proper result and control. It does not compare with our newly developed rubber-belt machine, which can operate at very high speeds — up to 100 yards per minute — and with the ordinary help generally found in finishing plants.

Q: How would you go about compressively shrinking a water-repellent-treated 80-square cotton sheeting, as you would be unable to wet the cloth before it goes through the electrically heated shoes even with wetting agents in the spray?

Lang: Actually, there have been millions and millions of yards of such fabric processed. The peculiar part is that enough water gets onto the fabric to enable the machine to work satisfactorily. This has been done in many, many plants and does not present any problem at all.

Q: In case that rayon is to be rehandled, such as rebleaching or stripping, will it be necessary to retreat it for shrinkage?

Leavitt: Very briefly I can answer that question with a "No." It is not necessary to retreat for shrinkage because, once you have effected the reaction between the glyoxal and the cellulose, the cross linkages that result from that reaction are permanent and will not be broken by acid stripping or bleaching.

Q: Why was no white fabric shown?

Leavitt: There was no reason for not showing white fabrics other than esthetic appeal. We have treated white fabric and there is lots of it around. White fabric must be bleached following the treatment so as to produce the desired quality of white. Again there is no reason other than appearance for not having shown you the white. As for permanence of the white, once you have produced the desired white rayon, it will always remain white.

Q: Is it commercially possible to have 0%-0% shrinkage?

Evans: With heat set synthetics, it is possible to have 0%-0% shrinkage. Various mechanical assistances must be employed. The goods must be handled in a reasonable way as far as extension is concerned, although we feel that it may possibly be a fact that on these thermoplastic yarns we can heat set them and produce a fabric which is like a pane of glass or like a piece of paper and still maintain the hand necessary for commercial fabrics, but that is a little distant at the present time.

Q: What are the shrinkage tests used on synthetics of this sort, I mean, standard tests other than this half-hour boil?

Evans: There are several standard tests employed on this type of material. The most usual one is the AATCC test with a hot steam pressing afterwards. There are quite a few hand-washing tests, but, first, the salient feature of any of these tests is in the heat level arrived at in the

washing, usually from 100 to 160° F; second, whether the fabrics, which, you understand, are usually elastic or stretchable, are ironed, straightened out, pressed, or extended. In fact, sometime ago, there was a very popular test which was called the Dimensional Restorability Test, with which, if the proper test was employed, you could get 0%-0% shrinkage or better on practically any knitted fabric.

Q: Do properly heat-set synthetics show progressive shrinkage?

Evans: By using the term "properly heat-set synthetics," you have limited the possibilities of that question a great deal, because a properly heat-set synthetic, under no circumstances will show progressive shrinkage.

Q: From your point of view, do fabric converters have their materials heat-set only for dimensional stability, or do they have it done for other virtues; in other words, are there a number of converters who do not care about dimensional stability?

Evans: You are speaking of thermoplastic materials which can be heat-set. The question of dimensional stability is important to all of them from every point of view. The fabric has to be dimensionably stable so that it will maintain its width; so that it will be resistant to shrinkage in wet washing; so that, in handling, the goods will maintain their position. That is, in a knitted fabric of this particular kind, a cutting that is not properly stabilized will curl, will move, will cause a large number of defects in further manufacturing processes, but the dimensional stability aspect, achieved by heat setting, will pretty well take care of all of them.

Q: Is the chlorinated process used for blends, I mean, for blends of cotton, wool, and the other synthetics?

Murphy: Most of the woven fabric being "SW" treated today is an 85% wool-15% nylon blend. However, we have also been treating 50% wool-50% cotton fabrics in the lighter weights, similar to Viyella. We are treating all wools, both woven and knitted, but these are the only two woven fabric blends that are being "SW" treated at the present time.

Q: May we have a little further information on the differentiation between "retention of chlorine" and "damaging chlorine retention?" Do you overcome harmful effects of chlorine retention in the glyoxal process?

Leavitt: This is not a question of overcoming any harmful effects. This is just a question of studying the nature of the beast. These formulations, which contain a minimum quantity of urea-formaldehyde resin, and which are designed primarily for shrinkage control, contain such a small amount of u-f resin that, while a starch-iodide test will show positive indications of retained chlorine, continuation of the AATCC Chlorine-Retention Test, which includes not only the impregnation of the fabric with the chlorine bath, but also a heat treatment of the dried fabric at 365° F for 30 seconds, followed by tensile breaks, will show absolutely no tensile reduction whatever despite the positive starch-iodide test. This would tend, then, to differentiate between "retained chlorine" and "damaging chlorine retention." To repeat the above briefly: you will find that a starch-iodide test, which is very sensitive, will indicate there is some chlorine retained in the fabric. However, the quantity of chlorine is of such small concentration that it is not enough to produce any tensile degradation when tested by the rest of the procedure recommended by the AATCC.

I will take that one step further. On extended washings with laundry formulations containing chlorine, urea-formaldehyde-treated fabric will show progressive degradation such that, after 20 launderings, you might get a reduction of tensile strength as high as 90%. Our glyoxal-processed fabric, under the same laundering conditions, will show, after the same 20 launderings, reduction of tensile strength somewhat in the neighborhood of only 20% despite the fact that it contains considerable concentrations of urea-formaldehyde resin. Now, this is, as I say, a matter of the nature of the beast. Despite the fact that we do have urea-formaldehyde resin present, it has been combined with the glyoxal and tied up with both the glyoxal and cellulose, so that a fabric so treated behaves differently from the ordinary urea-formaldehyde-treated fabric.

Q: Does a fabric treated with both glyoxal and urea-formaldehyde resin lose its characteristic hand on continued washing as rapidly as a fabric finished with urea-formaldehyde resin alone?

Leavitt: No, not nearly so rapidly. Glyoxal in a finish has a marked effect in preventing such rapid loss of u-f resin during repeated washing.

Q: What other processes are on the market for cotton woven goods; are other resins in use?

Lang: I don't know of any other processes except resin treatments, and they are in limited use at the present time because of tendering effects. In general, the resin treatments are not too widely employed at present. Cotton is very easily damaged by acid in contact with heat, and the resin treatments that employ acid catalysts and heat are quite damaging to cotton. Resins that don't need an acid catalyst should be used.

Q: How about the types that do not use an acid catalyst? How about the types that form a crystal that might rupture the fiber?

Lang: Well, that would be damaging to them.

Q: In what respect?

Lang: Even where a mild catalyst is used, the cured resin lowers abrasion resistance and tear strength.

Q: What is the purpose of rewetting agents in the "Sanforized" process?

Lang: The main thing is to let water make the fiber more plastic, and large quantities of rewetting agents are used for that purpose. It helps the process along, enables it to run more smoothly and more rapidly, and gives a very fine result.

Q: Please explain why chlorinated-wool fabrics wear better. Does this show up as an increase when tested by the usual abrasion test methods?

Murphy: The chlorinated-wool items mentioned earlier were hose, and these tests were conducted by the Quartermaster Corps at Camp Lee, Virginia. In the test, both the treated and untreated were subjected to normal wear and washing. The untreated socks, as would be expected, felted rapidly, and, although no holes developed, they were unwearable. Actually, because of nonfelting characteristics, the treated socks were in use for a much greater period than the untreated.

As to abrasion test methods, none are used to any extent in our own laboratory on wool. We have conducted investigations with both the Taber and the Stoll, but feel that, because of wide variations, in most fulled fabrics, the figures do not mean much.

Q: In cotton knit goods there is usually about 5 to 7% more shrinkage in tumble-dried than in screen-dried cloth. Is there this much difference in cotton woven goods? We presume it has been compressively shrunk in a proper manner.

Lang: Well, there will be some difference. I don't know if it will be quite that much though. Our standard wash test doesn't incorporate tumble drying. We either dry it on a flat screen, spray, and press the samples, or they may be simply extracted and then pressed. This is the general procedure in a laundry and is generally used in the laboratory. Now, you will get a little more shrinkage with tumble drying, but I would say that it would probably be in the nature of only 2 or 3% more.

Q: Do you feel, like the Underwear Institute, that perhaps there will be some changes in the standards of testing these things?

Lang: No, I don't think so. We have gone along for quite a few years with the test as it stands now, and I see no reason to make any change as far as woven goods are concerned. It is quite satisfactory and generally accepted the world over. If the test were changed to incorporate tumble drying and the fabrics were compressed several more percent, then they would be overshrunk when laundered without tumble drying. Such material, comprising the vast majority of goods, would then stretch when laundered.

Q: Are we going to have to depend on people taking garments out of the dryers before they are shrunk up?

Lang: These tumble dryers are quite new and people are not, so far, well aware of the possibilities involved in them. We have done some work with the manufacturers of the machines, and I believe that will be the angle we will work along in order to minimize any difficulty connected with them. As a matter of fact, we have not received very many complaints from this source. I am quite close to the "Sanforized" Division and know the problem at first hand. Some coveralls, which were not pressed but simply taken from the tumble dryer and used without pressing, were the only ones that caused much difficulty. Had they been properly sprayed and pressed, they would have been restored to almost their original size. It is not a proper procedure to take fabrics or garments from a tumble dryer and to use them without pressing.

Q: Do you find you have problems in this tumble drying?

Evans: Since most of the fabrics that are made from tricot are hand-washed, they are very rarely tumble dried until the garments are pretty old. However, I have seen many nylon garments come through a tumble dryer without any difficulty. I would suspect that that would not always be the case, though.

Murphy: As far as the tumble dryer is concerned, as Irv Smith said, it is used in the relaxing operation for knitted items, such as sweaters. The sweater is knit oversize, and then is washed, tumble-dried, framed out and finished. However, in the actual testing of treated knitted garments, the tumble drier has not been used except by the QM. Should it be used, if felting had been eliminated, the garment would over-relax. However, when rewet and dried by the conventional method, it would return to its original size.

Membership Applications

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Report of New York Section Outing

June 18, 1954

North Jersey Country Club, Wayne Township, N J

JOHN A Komninos of the Waldrich Co for the second successive year took low gross honors in golf at the annual outing of the New York Section on June 18th with a score of 76. The outing was held at the North Jersey Country Club with Chris W Farrell, Althouse Chemical Co, as chairman.

Close behind the winner were Robert W Brewer of American Aniline Products, Inc, 77; Richard L Jones of Royce Chemical Co, 78; William T Clarke, Arnold, Hoffman & Co, Inc, 79; and Ted Chadwick of Newburgh Bleachery, 80.

In the low net division winners were: John A Zelek of Interchemical Corp, 111-42-69; Ralph G Schaubhut of Nopco Chemical Co, 126-57-69; Hugh J Bonino of Metro-Atlantic Inc, 82-11-71; Carl H Tiedemann of American Cyanamid Co, 86-14-72; Shannon Mooradian of American Cyanamid Co, 86-14-72; and Charles Kloss, Jr, of Concord Dyeing & Finishing Co, 101-30-71.

Louis I Fidell of American Cyanamid Co won the horseshoe pitching tournament with Nicholas Stack of United Wool Dyeing Co second.

Prizes for the above events were awarded at dinner in the evening presided over by John H Hennessey, Berkshire Color & Chemical Co, vice chairman of the section, in the absence of Weldon G Helmus, Fair Lawn Finishing Co, chairman. Mr Hennessey read a letter of greetings to the members from Mr Helmus who was in Switzerland at the time. Mr Hennessey also expressed appreciation for the efforts on Mr Farrell to make the outing a success.

The fashion plate award of the Martin Weiner Co for the most colorful sport shirt was presented by Charles Minoff of that company to William R Calabrese of Paulden Laboratories. Judges for this event were Mr Hennessey, Joseph S Lange of Geigy Co and Edward H Staab of Nova Chemical Corp.

The events of the evening were concluded with the distribution of many door prizes.

Assisting Mr Farrell on the outing committee were Robert F Holoch, National Aniline Division, Allied Chemical & Dye Corp, *horseshoes;* John A Komninos, *golf;* Richard P Monsaert, Jr, of Puritan Piece Dye Works, Inc, *swimming;* and Michael F Costello, Jacques Wolf & Co, *reception.*

A special gift was presented to Mr Holoch for 21 years service at the outings.

Mr Hennessey announced that Robert W Brewer would be chairman of the outing committee for 1955.

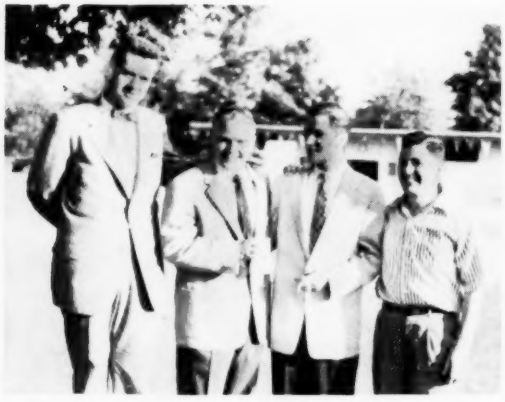
The attendance was over 350.

Chris W Farrell, outing chairman (left), presents low gross trophy to John A Komninos. Also in the picture are John H Hennessey, New York Section vice chairman (standing) and George L Baxter, AATCC vice president

John A Zelek, winner of the low net award

Solid citizens—(l to r): John H Hennessey, Berkshire Color & Chem Co; James J Marshall, American Aniline Products, Inc; John A Komninos, Waldrich Co

Mr Hennessey examines a structural formula



(L to r): James A Doyle, Howes Publishing Co; Frederick B Hennessey, Waldrich Co; James M Polito; Francis Habersberger, Kelco Co.

Principals in the Martin Weiner fashion plate award: (l to r): Chris W Farrell, Althouse Chemical Co; Charles Minoff, Martin Weiner Co; William R Calabrese, Paulden Laboratories (winner); John H Hennessey, Berkshire Color & Chem Co; Joseph S Lange, Geigy Co (judge); Edward H Staab, Nova Chem Corp (judge); L M Berliner, Martin Weiner Co.

• Emmerich Heads New MCA Officer Slate

Fred J Emmerich, president of Allied Chemical & Dye Corp, was elected chairman of the board of directors of the Manufacturing Chemists' Association, Inc, as that society met for its 82nd annual meeting last month at White Sulfur Springs, W Va. Mr Emmerich succeeds Charles S Munson, Air Reduction Co, who was elected to the newly created post of chairman of the executive committee. William C Foster, full time president and director, was re-elected.

Other officials were elected as follows:

Vice presidents—Howard S Bunn, Union Carbide and Carbon Corp; William H Ward, E I du Pont de Nemours & Co, Inc.

Directors—(For the term expiring May 31, 1957): Leland I Doan, The Dow Chemical Co; John Fennebresque, Celanese Corp of America; Joseph Fistere, Mallinckrodt Chemical Works; A E Forster, Hercules Powder Co; John L Gillis, Monsanto Chemical Co; R K Gottshall, Atlas Powder Co; R C McCurdy, Shell Chemical Corp; Mr Ward and Mr Foster. *(For the term expiring May 31, 1956):* V G Bartram, Shawinigan Chemicals, Ltd; J Clarke Cassidy, Niagara Alkali Co. *(For the term expiring May 31, 1955):* Charles E Wilson, Grace Chemical Co.

• Chemurgy Products, Inc Formed

Edward J Jaskwhich, former vice president of Polymer Industries, Inc and Polymer Southern, Inc, has formed a new company, Chemurgy Products, Inc, with offices in Greenville, S C.

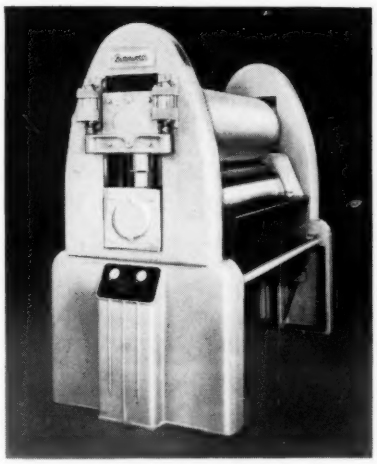
In addition to being president of the new firm, which will manufacture and distribute compounds for sizing and finishing, Mr Jaskwhich will represent Delany & Co, Inc of Philadelphia.

• Crown Awards

The following awards have been procured by the Crown Chemical Corporation, 240 India St, Providence 3, R I:

a) 111,435 lbs of Compound Water Repellent for the re-treatment of garments for the Veterans Administration, Washington, D C.

b) 160,820 lbs of Compound Water Repellent for the re-treatment of garments for the Quartermaster Depot, U S Army, Philadelphia, Pa.



Butterworth "Rocket"

• Butterworth Introduces "Rocket" Finisher

The standard "Rocket" and the "Auto-Rocket" are among the new machines which have been introduced to the textile finishing trade recently by H W Butterworth & Sons Co, Bethayres, Pa.

The standard "Rocket" is built to provide independent pressure control for each side of the machine, and is used where there are frequent applications for different pressures per side. The "Auto-Rocket" can do everything the standard "Rocket" can do, but in addition, it is equipped with pressure-equalizers which are designed to automatically maintain absolute uniformity of pressure across the face of the rolls. If separate pressure control is required using the "Auto-Rocket," it can be obtained by shutting off the automatic pressure equalizer.

Either unit can be used as a padder, 2- or 3-roll; mangle, 2- or 3-roll; embossing calender, 2-roll; or rolling calender, 2- or 3-roll.

Hydraulic-pneumatic control of roll pressure ranges from 0 to 30 tons. Controls are built into the unit. Driven roll at bottom is stainless steel; top roll is rubber. To convert to any of the four applications, it is necessary to remove the top cap of the machine frame and lift the rolls out of the machined guides. Both are furnished completely piped and in changing rolls no lines need be disturbed.

Standard roll widths are 50", 60", 66" and 72"—other widths are furnished as required.

• GDC-GAF Merger Completed

Formal completion of the merger of General Dyestuff Corporation with General Aniline & Film Corporation was approved by the GAF Board of Directors at a meeting on July 1st. The merger follows the purchase by General Aniline last November of all the stock of General Dyestuff.

Both companies have been under Government control by virtue of the vesting of all of GDC stock and 98% of General Aniline stock shortly after the start of World War II.

General Dyestuff has been the sales agent for General Aniline dyestuffs and chemicals since it was organized in 1926. The sales agency represented the consolidation of three of the oldest dyestuff companies in the United States—H A Metz & Co, Grasselli Chemical Co, and Kuttroff, Pickhardt & Co, the latter tracing its history back to 1871.

The marketing and sales of dyestuffs now will be carried on under the name of the "General Dyestuff Company" to retain the "GDC" monogram, which is well known throughout the industry. "General Dyestuff Company" will be a sales division of General Aniline. General Aniline's special chemical products will be sold and distributed by Antara Chemicals, another GAF sales division, which was formerly a part of General Dyestuff Corporation.

• Perkins Opens Southern Sales Division

B F Perkins & Son, Inc, Holyoke, Mass, have announced the opening of a Southern sales division in Charlotte, N C, which will be headed by Benjamin C Trotter.

Established in 1873, B F Perkins & Son, Inc manufactures a complete line of calender rolls for the textile and paper industries, seam and slub detectors, cloth pilers, drying machines, mangles, padders, squeezers, winders, plastic embossing machines, hydraulic power units, and Mullen testers.

• H D Kampf Sons Relocates in Jersey

H D Kampf Sons Inc, formerly of Brooklyn, N Y, have moved their offices, laboratory and warehouse to 140 Liberty St, Hackensack, N J. The firm has been in the dyestuff and chemical field since 1914.

• Foxboro Branch Factory in Pittsburgh

Scheduled for completion by August 1 is a new 15,000 square foot plant being constructed at 2270 Noblestown Road, Pittsburgh, Pa, by The Foxboro Company. The new factory, which will double the present instrument assembly, service and repair facilities, is being erected on two levels. General offices and sales headquarters will occupy the lower level, with an upper level extension of 12,000 square feet where instruments and control valves will be assembled, serviced and stocked. The building is situated on a two-acre site with ample space for parking and for a future third level expansion.

The Pittsburgh factory is the second of three to be erected this year as part of Foxboro's expansion program. A new plant in Dallas was opened in April and another in San Leandro, California, will be ready for occupancy by August 15.

The Foxboro Company has maintained Pittsburgh sales offices and repair facilities since 1918 and has occupied its own shop at 5151 Baum Blvd since 1941. A H Shafer, who joined the company in 1921, continues in charge as district manager.

• Interchemical Establishes New Department

Interchemical Corporation has announced the formation of a Product Application Engineering Department, which will deal with the problems posed by the inter-relationship of chemistry and mechanics in the application of the chemical coatings produced by the Corporation.

The responsibilities of the new unit will include:

1) Providing the central research laboratories and the divisional development laboratories with information and assistance in projects where problems of mechanical application or control are involved.

2) Assisting the operating divisions in the sale of their products (particularly new developments) where mechanical problems are involved.

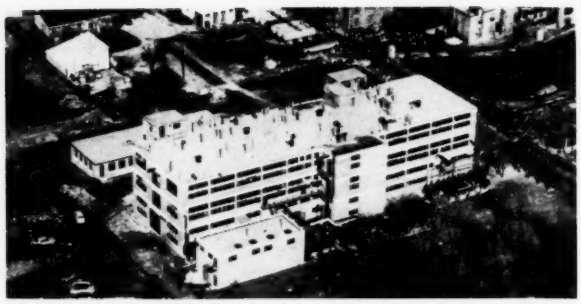
3) Informing research units about new developments in control instruments and application equipment.

4) Working with outside sources to develop instruments or equipment needed for the most advantageous use of the chemical coatings produced by Interchemical.

• Hooker Host to Montague Visitors

Hooker Electrochemical Co, Niagara Falls, N Y, played host at Montague, Mich, on June 18th, to a group of approximately 225 people visiting its newly-opened $12 million caustic soda and chlorine plant. The majority was composed of representatives of chemical-consuming industries. They were accompanied by Hooker officials and sales representatives.

The visit included a stop at the B C Cobb Station of Consumers Power Co at Muskegon, Mich, which provides power for the new plant 14 miles away.



Air view of Arnold, Hoffman's new plant at Dighton, Mass.

• Arnold, Hoffman Celebrates "Open House" at Dighton

Arnold, Hoffman's new multi-million dollar plant extension at Dighton, Massachusetts was formally added to the Company's operating facilities at an Open House held on Friday, May 21, at which time officials of the Company welcomed approximately 350 customers, stockholders and friends of the firm.

Visitors were conducted on a tour of the plant by members of the staff, who described its facilities and the methods of operation. A display was also provided in the new refectory demonstrating some of the applications for the Company's dyestuffs and auxiliary products.

Following the visit to Dighton, the guests were entertained at a buffet supper at the Squantum Club in East Providence.

Although the new facilities are intended primarily for the production of intermediates and vat dyestuffs, they are reportedly capable of producing a wide range of products in the organic chemical field.

• Westvaco to Build Anhydrous Ammonia Plant

Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corporation, New York, has been authorized to build an anhydrous ammonia unit at its South Charleston, W Va, plant. A Certificate of Necessity has been issued providing for accelerated depreciation of 45% of cost. The new plant with a capacity of 60 tons per day will use by-product hydrogen from Westvaco's electrolytic chlorine-caustic soda operations. Completion is scheduled for the third-quarter 1955.

• Becco Reduces H_2O_2 Prices

Becco Sales Corporation, Buffalo, N Y, has announced reductions in the price of hydrogen peroxide amounting to slightly over 6% for tankcar quantity, the reductions covering 27.5%, 35%, 50% and 90% H_2O_2 concentrations. At the same time, prices for the chemical in aluminum drums have also been lowered.

• Honor Awards at NBITT

Several outstanding students of the Class of '54 at the New Bedford Institute of Textiles and Technology as well as a number of underclassmen have received special recognition in the form of various awards of merit.

The following seniors were presented awards at the 54th commencement exercises of the Institute on June 4th:

AWARD	RECIPIENT
American Association of Textile Chemists and Colorists	James H Siddall, Jr
National Association of Cotton Manufacturers	Donald M Stewardson
American Association of Textile Technology, Inc	Jacqueline E Boucher
Fred E Busby (Chemistry)	Vasco G Camacho
Morris H Crompton (Mechanical)	Robert C Randall
Samuel Holt (Designing)	William A Silveira
Phi Psi	Robert E Griswold
Delta Kappa Phi	Richard F Lafferty

The following freshmen received their honors during the final assembly of the entire student body:

AWARD	RECIPIENT
William E Hatch Key for excellence in textile engineering	William E Giblin
Hon Samuel Ross Award for excellence in textile manufacturing	Henry Galary
New York Alumni Scholarship to the outstanding freshman	Daniel J Morrison
Chemical Rubber Publishing Co Awards for proficiency in physics	Daniel J Morrison
proficiency in mathematics	John Pacheco
American Association of Textile Chemists and Colorists Essay Award	Ralph P Boyd

• Bakelite Licensed by Elastomer

The Bakelite Company, a Division of Union Carbide and Carbon Corp, has concluded an experimental licensing agreement with Elastomer Chemical Corp, Newark, N J, under patents held by Elastomer for foaming vinyl resin plastisols.

Mixtures of vinyl resins and plasticizer have many interesting properties applicable in the field of flexible foamed products similar to foamed rubber and appear to have many significant qualitative and economic advantages over foamed rubber products.

Bakelite is now prepared to work cooperatively with all other licensees under those patents in the commercial application of Bakelite vinyl resins to this newly developing field.

• 125 Attend Housewarming at Stowe-Woodward's Wisconsin Plant

E W Peterson (left), Stowe-Woodward's president, watches Werner Joncher perform the lathe work in preparation of a roll core.

As the first step in processing rubber-covered rolls at Stowe-Woodward's Neenah plant, the rubber is extruded through the strainer in preparation for compounding.

Textile finishers and paper mill executives had an opportunity last month to view firsthand the new roll-covering plant established by Stowe-Woodward, Inc at Neenah, Wis.

Conducted through the plant in small groups of 6 to 8, more than 125 visitors witnessed the extensive facilities for the complete processing of rubber-covered rolls from crude rubber to the finished product. Equipment at the new plant duplicates the facilities of Stowe-Woodward's Newton, Mass, plant.

Manufacturing, laboratory and office space have been leased from the J W Hewitt Machine Co, which has served Wisconsin industry for more than 30 years.

The opening of the Neenah plant highlights the first step in a carefully planned program of expansion which brings Stowe-Woodward service closer to the industries it serves. The new plant will serve the Mid-West through sales engineers Jack Dickson, headquartering in Kalamazoo, Mich, and Dave McRitchie, headquartering in Franklin, Ohio. Plant manager William Nordo, and his assistant, Will Chandonait, have transferred to Neenah from Newton.

Stowe-Woodward's products, including the patented Stonite, Microrok, Tannite, and Sto-Prene coverings are currently in use in several Midwestern mills.

• Prices Reduced on Ethyl Silicates

Carbide and Carbon Chemicals Co, a Division of Union Carbide and Carbon Corp, has announced a new schedule of prices for ethyl silicate, ethyl silicate 40, and tetraethyl orthosilicate. The new prices, now on a delivered basis, represent reductions of 1-6.5 cents per pound from the previous fob shipping point prices.

• 3rd Avisco Textile Seminar

Faculties of the nation's leading textile schools had the opportunity of examining the latest developments in rayon, acetate and other man-made fibers last month during the American Viscose Corporation's third textile seminar, which was held June 16-18 at Avisco's Textile research Department at Marcus Hook, Pa. The two previous seminars were held in 1946 and 1950.

General subjects were covered during the morning sessions, and electives during the afternoons. The general subjects which were covered by TRD staff members, included "Economic Significance of the New Fibers," by Rene Bouvet; "Fibers in Blends," by Robert A Smith and W W Bowman; "Fiber Identification," by W R Wilson; "Progress with Acrilan and Nylon," by S J Davis of the Chemstrand Corporation; "Behavior of Fiber Blends in Fabric," by Mr Bouvet and J M Roughan, and "Finishing of Blended Fabrics," by Leslie L Walmsley.

The electives included discussions and demonstrations of strain gauge measurement of tension, use of the spectrophotometer, textile microscopy, yarn and staple testing, handling of yarn and fiber complaints, and visits to the corporation's pulping and acetate pilot plants, in addition to visits to the various divisions of TRD and discussions with their staffs.

Wilbur A Swanson

WILBUR A SWANSON, 42, a salesman for Glasco Equipment Co, Paterson, N J, died on May 24th in Barnet Hospital, Paterson.

A member of the New York Section, AATCC, Mr Swanson lived in Glen Rock, N J.

He is survived by his widow, Mrs Jane Hathaway Swanson; two daughters, a brother, and a sister.

• Large Turnout at CCNE Outing

Over one hundred and thirty members and guests turned out for the annual golf outing of the Chemical Club of New England on June 23 at the Pawtucket Golf Club, Pawtucket, R I, which saw Andrew Gard of Versenes Inc take low gross honors.

Other awards went to R E Nippes, Columbia-Southern Chemical Corp (2nd low gross); H S Kishbaugh, Solvay Process Division, Allied Chemical & Dye Corp (3rd low gross); W H Eastburn, Mathieson Chemical Co (1st low net); J T Shelly, Hercules Powder Co (2nd low net); Charles Karkalitis, Hoffman-LaRoche, Inc (3rd low net); Enoch Edwards, Arnold, Hoffman Co (longest drive); and Thomas Anderson, J U Starkweather Co, Inc (nearest to the pin).

Arrangements for the outing were handled by John E Upham, Hercules Powder Co.

• Blaw-Knox Offers Belgian Continuous Fatty Alcohol Process

Blaw-Knox Company, Pittsburgh, Pa, is making available to U S industry the Belgian SBA* process for the production of fatty alcohol by continuous hydrogenation.

The Pittsburgh firm, exclusive licensing agent for the process, reports that the technique is currently operating successfully, and claims to be in a position to erect complete and integrated plants for the production of fatty alcohols, using this process, with stipulated guarantees regarding product quality, yield, operating cost, and catalyst life.

Pilot plant facilities are available for the testing of raw feed materials of domestic origin. The SBA pilot plant is said to be a simple, efficient unit, capable of continuous operation similar to that of full-scale plants. It can process one barrel of fat or fatty acid per day and its results, such as yield and catalyst life, can be projected accurately to commercial operation, it is claimed.

The SBA process consists of the following steps:

1) Continuous methyl ester production.
   a) Transesterification
   b) Fat splitting followed by esterification
2) Continuous hydrogenation of the carboxy group.
3) Continuous hydrogenation of the unsaturation existing in the raw material.
4) Continuous fractional distillation of the crude alcohol.

* Societe Belge de L'Azote et des Produits Chimiques du Marly.

NAMES IN THE NEWS

Askin

Wurzburg

LeClair

SIMON ASKIN, president of Heyden Chemical Corporation, was elected president of the Armed Forces Chemical Association, New York Chapter, at a luncheon meeting held at the Hotel Belmont Plaza on June 15th. Mr Askin succeeds Major General WILLIAM N PORTER, USA retired, chairman of the board of Chemical Construction Corporation.

CARLTON BATES, executive vice-president of the Solvay Process Division of Allied Chemical & Dye Corporation was elected first vice-president. ROBERT MILANO, president of Millmaster Chemical Corporation, was re-elected second vice-president and WALTER E SPICER, manager of the Quality Control Department of the Lambert Pharmacal Company, was re-elected secretary-treasurer.

Directors include WILLARD JACOBS, chairman of the board of Niagara Alkali Corporation, S M CUMMINGS, president of Pylam Products Corporation, EDWIN C KENTON, vice-president of Evans Chemetics, Inc. General Porter, Mr Askin, Mr Bates, Mr Milano and Mr Spicer.

F L WURZBURG, JR, will head the newly established Product Application Engineering Department of Interchemical Corporation (see page 480), assisted by WILLIS E LECLAIR, and will report to NORMAN S CASSEL, vice president for research and development.

N B SOMMER, manager of American Cyanamid Company's New Product Development Department has assumed the post of presidency of the Commercial Chemical Development Association following his election at a recent meeting in New York. He succeeds W E KUHN of The Texas Company.

J W ZABOR, research director of Pittsburgh Coke & Chemical Co since 1949, has been appointed to the newly created position of assistant to W K MENKE, vice president—chemicals. In his new position Dr Zabor will be particularly concerned with the company's over-all technical program, and will also be responsible for the company's patent and trademark activities and technical contracts.

E O OHSOL, formerly director of chemical engineering, succeeds Dr Zabor as research director.

Luttringhaus

Ames

Greene

Progressive Color and Chemical Company, New York, has appointed HANS LUTTRINGHAUS as technical consultant on dyestuffs and textile auxiliaries produced by Farbwerke Hoechst, Frankfurt-Hoechst, Germany, and Metro Dyestuff Corp, West Warwick, R I.

For more than 17 years Dr Luttringhaus has been with General Dyestuff Corporation.

FORREST C AMES has joined the Wiesner-Rapp Company, Buffalo, N Y, manufacturers of dyeing and wet-end finishing machinery, in a sales engineering capacity. Mr Ames, who has had over 20 years experience with textile finishing machinery, will cover the U S and Canada.

Standard Chemical Products, Inc, Hoboken, N J, and Charlotte, N C, has appointed LEWIS C GREENE to its sales staff, to cover parts of North and South Carolina and Georgia, with headquarters in Greenville, N C.

Before joining Standard, Mr Greene resigned the position he held for the past four years as superintendent of the cotton division, North Carolina Finishing Company, Salisbury, N C.

Zinsser & Co, Inc, Hastings-on-Hudson, N Y, has appointed WALTER E COLEMAN sales manager of their Dry Color Department. Mr Coleman was formerly with Reichhold Chemicals, Inc, as a salesman covering the Philadelphia and New York metropolitan areas, and previously was a chemist in their research laboratories.

WINSTON PAUL, chairman of the board of General Aniline & Film Corporation and General Dyestuff Corporation, has been elected chairman of the Columbia College Council. His term will be for one year.

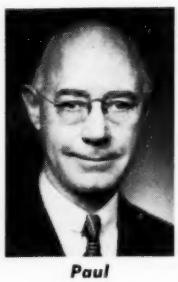
W H T FURRY has been named director of the Training and Educational Division of the Foxboro Company, Foxboro, Mass, succeeding MALCOLM B HALL, who recently completed 40 years of service with the firm.

Mr Furry will be assisted by K A BELL, associate director of training.

Sommer

Zabor

Ohsol


Paul

Furry

Hall

R N Graham

Reich

Babcock

AUGUSTUS B KINZEL has been appointed director of research, Union Carbide and Carbon Corporation, where he will be responsible for the administration and co-ordination of the research in all Divisions of the Corporation. Dr Kinzel has been actively engaged in research work with Carbide since 1926, when he joined Electro Metallurgical Company. He became vice-president of the latter in 1944.

In the Carbide and Carbon Chemicals Company, a Division of Union Carbide, ROBERT N GRAHAM and WILLIAM F REICH, JR, have been appointed executive vice-presidents. They have been respectively vice-presidents in charge of production and of sales.

Newly appointed vice-presidents at Carbide and Carbon Chemicals Co are N C BABCOCK, former manager of the Industrial Chemicals Division; E E FOGLE, former sales manager of the Industrial Chemicals Division; and H D KINSEY, former works manager. DONALD B BENEDICT has moved up from assistant works manager to succeed Mr Kinsey.

Among those receiving the honorary degree of Master of Science at the 54th commencement exercises of the New Bedford Institute of Textiles and Technology on June 4th were JOHN H GRADY, Dyestuff Department, American Cyanamid Co; BASIL BREWER, New Bedford (Mass) Standard Times; RUDOLPH C DICK, Naumkeag Steam Cotton Co; SEABURY STANTON, Hathaway Mfg Co; ANDREW MACEY, Nashaweena Mills; and WILLIAM A KARL, Textile Div, Firestone Tire & Rubber Co.

Within the Hooker Electrochemical Company organization, HIRAM M YOUNG, former works manager of the Niagara Falls, N Y, Ashtabula, O, and Montague, Mich, plants, has been elected vice president in charge of eastern production; and THOMAS E MOFFITT, formerly western manager of the company's Tacoma, Wash, plant and other west coast activities, has been elected vice president in charge of western operations. F LEONARD BRYANT, formerly superintendent of the Niagara plant of the company, has been named works manager of this plant.

DONALD A BUCHANAN and CLEMENT H DARBY, JR, have been added to Hooker's chemical engineering staff in the Research and Development Department; and RICHARD F GRAHAM has been promoted to sales representative with headquarters at Wilmington, Calif.

Stearns

Pierce

Fortenbaugh

EDWIN I STEARNS, former manager of product improvement for the Dyestuff Department, American Cyanamid Co, has been appointed assistant manager of the Department's mid-western territory. His headquarters will be at 3505 N Kimball Ave, Chicago, where he will be associated with S KLEIN, mid-western manager.

Also within the Cyanamid organization, THOMAS P TURCHAN has been named manager of manufacturing for the Agricultural Chemicals Division; W D HOLLAND has been named manager of manufacturing for the Plastics and Resins Division; and GAILON C FORDYCE has become assistant director of purchases.

Cyanamid's Research Division has announced the appointments of ELLIOTT S PIERCE and ROBERT B FORTENBAUGH as group leaders in the Textile Resin Research Section.

WILLIAM A CORRY, former civilian chief of the textile branch of the Air Research and Development Command, Wright-Patterson Air Force base, has joined the research and development staff of the Landers Corporation, manufacturers of processed and coated fabrics. Mr Corry will serve as assistant to C J CHABAN, chief chemist.

JOHN F O'NEIL has joined the research staff of Emkay Chemical Company, Elizabeth, N J. He has worked during the past twelve years with Colgate-Palmolive Co, National Oil Products, Yeast Products Co, and Colloids Inc.

CHARLES SCOTT VENABLE has retired as director of chemical research of American Viscose Corporation after 22 years of service. Dr Venable will remain with the corporation in a consulting capacity.

RICHARD M LAWRENCE, senior market analyst in the general development department of Monsanto Chemical Co since 1947, has been named director of business research for Wyandotte Chemicals Corp. He will headquarter in Wyandotte's new research center in Wyandotte, Mich.

Wyandotte's Michigan Alkali Division has announced the appointment of JAMES G MINAHAN as a resident salesman operating out of the Company's Eastern District Office in New York. From headquarters in Philadelphia, he will cover metropolitan Philadelphia and eastern Pennsylvania.

Fogle

Kinsey

Grady

Corry

O'Neil

Minahan

Engs

Hanes

Eddington

WILLIAM ENGS, formerly manager of manufacturing of the Agricultural Chemicals Division, American Cyanamid Company, has been appointed assistant to the president of Stauffer Chemical Company, its subsidiaries and associated companies.

The Board of Directors of Sandoz Chemical Works, Inc have announced the election of A T HANES, JR as vice-president in charge of sales.

Mr Hanes joined Sandoz in 1928 in the Sales Department of the Charlotte, North Carolina, branch. In 1943 he was appointed sales manager of the Charlotte Office, which position he has occupied to date.

ELLWOOD M EDDINGTON has joined Dow Corning Corporation's textile service department to assist F L DENNETT in the application of silicone finishes. He comes to Dow Corning from the Old Fort Finishing Plant, Old Fort, N C, where he was plant superintendent.

WILLIAM G REVELEY, formerly director of exploratory research for National Aniline Division of Allied Chemical and Dye Corporation, has been appointed assistant director of research for Rayette, Inc, St Paul, Minn. Dr Reveley will be responsible for product development and chemical research for Raymond Laboratories, Inc, a subsidiary of Rayette active in chemical manufacturing, as well as for Rayette, Inc.

PHILIP PENSAK has joined the Department of Research and Development of the Colgate-Palmolive Company as a chemist in the Analytical Laboratory. He was previously employed by the Armed Services Medical Procurement Agency, Brooklyn, N Y.

CARL F PRUTTON, vice president and technical director, Chemical Divisions of Food Machinery & Chemical Corporation, New York, was awarded the honorary degree of Doctor of Engineering at the 78th commencement exercises of Case Institute of Technology last month.

Amidon

Stanley

DeWolfe

Rodney Hunt Machine Co, Orange, Mass, has announced the appointments of CHARLES H AMIDON as assistant manager of the Textile Machinery Division, and HENRY E STANLEY, JR, to the Division's sales staff.

Mr Amidon has been associated with Rodney Hunt for the past seven years, working at the factory and in the field as a design engineer on textile wet-processing machinery.

Mr Stanley will be the Rodney Hunt sales engineer in the New England area. Before coming to Rodney Hunt, he was connected with American Cyanamid Company's Textile Resin Dept.

As the newly appointed supervisor of New York sales for National Starch Products, Inc, ROBERT DeWOLFE will be responsible for adhesive sales in New York and northern New Jersey, permitting LESTER LEMPNER, eastern sales manager, to devote more time to overall eastern sales.

JOHN E BIEGNER has been named New York area district manager of Hercules Powder Company's Synthetics Dept, succeeding PAUL LEFEBVRE, who is resigning from the company for reasons of health. Mr Lefebvre will remain in the New York office, as special representative, until August 31.

EDWIN S MOLER, JR, and ROBERT C BOGOTT have joined the Department's Development group.

ROBERT E MUNSELL has joined American Resinous Chemicals Corp, Peabody, Mass, as technical representative in New England. For the past several years Mr Munsell has been in charge of technical development for the Latex Compounding Dept, Stein-Hall & Co, New York.

EDWARD J GOETT, who for the past 12 years has been employed by the Charles Pfizer Company, has been appointed director of a newly created Commercial Development Department by the Atlas Powder Company.

GENERAL CALENDAR

AMERICAN CHEMICAL SOCIETY
National Chemical Exposition—Oct 12-15, Chicago, Ill.

AMERICAN SOCIETY FOR QUALITY CONTROL
Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles.

CHAMBRE SYNDICALE TRAMAGRAS
International Detergent Congress—Aug 30-Sept 5, The Sorbonne, Paris, France.

DELTA KAPPA PHI FRATERNITY
1955 Annual Convention—April 29-30, Lowell, Mass.

DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN
Achema XI—May 14-22, 1955, Frankfurt am Main, Germany.

THE FIBER SOCIETY
Fall Meeting—Sept 13-14, McGill University, Montreal, Canada.

Spring Meeting—May 4-5, 1955, Alabama Polytechnic Institute, Auburn, Alabama.

Fall Meeting—Sept 8-9, 1955, Massachusetts Institute of Technology, Cambridge, Mass.

INTERNATIONAL CONGRESS OF INDUSTRIAL CHEMISTRY
27th Congress—Sept 11-19, Brussels, Belgium.

INTERNATIONAL TEXTILE EXHIBITION
2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE
September, 1955—Sydney, Melbourne, and Geelong, Australia.

NATIONAL COTTON COUNCIL OF AMERICA
1954 Chemical Finishing Conference—Oct. 7-8, Hotel Statler, Washington, D. C.

NATIONAL INSTITUTE OF DRYCLEANING
4th Educational Conference—Dec. 5-10, Silver Spring, Md.

SOUTHERN TEXTILE EXPOSITION
October 4-9 (Textile Hall, Greenville, S C).

TEXTILE RESEARCH INSTITUTE
25th Annual Meeting—March 10-11, 1955, Hotel Commodore, New York, N. Y.

TEXTILE TECHNICAL FEDERATION OF CANADA
4th Seminar—Sept 9-11, Queen's Univ, Kingston, Ont.

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